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The Journal of the Telephone Industry

★

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CONSTRUCTION MATERIALS

for Outside Plant

By Ray Blain

***BETTER CONSTRUCTION** at lower cost made possible by numerous improvements and refinements in outside plant materials now available. Of prime importance is the selection of materials best suited to a particular job. Part 1 of this article, appearing on this and following pages, discusses poles, crossarms and pole line hardware, and insulators used on pole lines*

NUMEROUS changes in the telephone industry—from its very beginning down to the present—have been caused by the march of time. These changes have not in all cases meant progress for we have had numerous setbacks, such as unprofitable rates, sleet storms, rural electrification and now the wages and hours act. But we must not lose sight of the fact that we have also enjoyed many blessings.

Perhaps the greatest of these blessings have been the numerous improvements in outside plant materials which have resulted in better construction at lower costs. The many manufacturers deserve a sincere vote of thanks, for without the benefit of these improvements in the various classes of materials, the larger telephone systems of today would not be possible.

It is strange but true that these new and better materials—due to improved methods of manufacture, better ingredients and mass production—may be purchased at a much lower cost than could the inferior articles of several years ago. The only problem remaining today, in the writer's opinion, is the selection of materials which may be best suited for each particular job.

In this article an attempt will be made to describe briefly some of the newer developments in materials and to make a few suggestions as to how they may be used to advantage in any modern telephone exchange plant. The proper selection of materials is important as it may result in a considerable annual saving to any telephone company.

While it is true that a large percentage of telephone plant is being placed underground, it is likewise true that poles continue to be used in even greater amounts than at any previous time in the history of the telephone industry. Records indicate that, in the aggregate 4,217,621 treated poles were required in 1937 by the pole-using public utility companies.

When the great increase in the life of poles due to the use of wood preservatives, is taken into consideration, some idea of the enormous annual pole consumption is had. It is not at all unusual for present-day poles to have an average life of well over 35 years in any section of this country.

Formerly poles carried the alphabetical classification and were divided into the following classes: AAA, AA, A, B, D, E, F, and G. New specifications have been developed by the American Standards Association which recommends that the classification be designated by the numerals 1 to 10 inclusive. These new classifications should prove of great benefit to all users of poles.

All conditions found in pole-line construction have a calculated moment of resistance for the pole at the ground level, the required magnitude of this moment being the product of the computed bending moment and the predetermined factor of safety.

This resistant moment is a function of the size of the pole at the ground level and the fiber strength of the timber species under consideration. The object of the new dimension tables is to specify a range of pole sizes adequate to meet all conditions of load encountered on any line.

This new classification is designed with a view of presenting a definite correlation of strength between poles of the same class and between poles of all lengths in any class. Likewise,

This pole line was placed under an overpass to avoid the use of exceptionally long poles on an overhead crossing.

there is a definite correlation of strength between poles of the same class and length in the different species of wood.

The classes of poles in the new tables are designed by number to distinguish them from the old "lettered" classes or regular top-sized poles.

Top circumferences of each class are the same in all species.

Dimensions are shown in terms of circumference in inches at a point six feet from the butt (except in classes 8, 9 and 10), and of circumference in inches at the top in all classes.

Classes 8, 9 and 10 have no butt dimensions specified, for ordinarily these top dimension poles will be used primarily for light-loaded lines or on special construction where the ground level strength is not so important as the need for a certain top size. These three classes provide poles for those who may prefer to order poles by top dimensions.

The measurements in the new tables for tops and six-foot-from-the-butt circumferences are minimum. Actual measurements of cedar poles are materially larger so that the average size cedar pole will be about midway between the minimum of its class and the minimum of the next higher class.

The remark that pole timber is rapidly being exhausted has frequently been heard but nothing could be farther from the truth. Occasionally it is stated that the supply of a certain type timber is becoming scarce; neither is this true.

It is true, however, that certain types of timber for poles 30 feet and longer are not now produced in large quantities, but this length is not used extensively at the present time in the telephone industry. Poles are available in almost any quantity in the 16, 20 and 25-foot lengths, and these are the sizes most commonly used in the telephone industry at the present time.

However, poles from 30 to 110 feet are still available in reasonable quantities, but as their use in telephone work is generally confined to special jobs, the demand for them is not great. Rather than use extra high poles over a railroad track at the present time, the average manager prefers the use of cable and an underground crossing.

Present-day poles are so uniformly good that the occasional failure recorded can ordinarily be traced to improper line design and not in any way to defects in the poles themselves. Poles set in the line, and not guyed, offer a resistance to overturning by the ground in which they are set. If such poles are to properly handle the strain, it is of utmost importance that they be set in the ground to the proper depth.

The tables of setting depths for all lengths of poles should be strictly observed to insure proper line strength and maximum pole value. When heavy, open-wire lines are loaded with sleet, poles occasionally kick out of the ground. That is not an indication of their weakness but is certain proof that they were not set to the proper depth in the first place.

Many advantages may also be gained by a careful study of the route when laying out a cross-country pole line. The present trend is to locate pole lines parallel with paved roads so that they may be covered quickly by automobile for maintenance purposes.

Many companies also locate pole lines a few feet from the pavement. This provides a better grade for the line and much cheaper maintenance than when the line is located out in the open, especially through a hilly country. It may be possible that the highway authorities will not permit this practice in some states, but where it can be used it should react to the benefit of the telephone company.

Crossarms, Pins and Wood Brackets

Crossarms are, as a rule, dependable and change very little in design or quality from year to year. Standard pony crossarms have two, four, six, eight, or ten pins and are from 24 inches to 102 inches in length. A few years ago some of the larger telephone companies altered their specifications so as to permit the use of dense structural grade douglas fir lumber which provides somewhat greater mechanical strength at a lower cost than crossarms made from clear douglas fir lumber with no density requirements.

The principal requirements of a good crossarm are lightness, strength and durability. Ordinarily douglas fir meets these requirements. However, long-leaf yellow pine and creosoted crossarms in either fir or yellow pine may sometimes be obtained. The majority of companies, however, prefer the use of fir without painting or the use of preservatives of any kind. Fir also provides more than double the required strength with a large margin of safety.

Two-piece transposition insulators in use.

Perhaps the most neglected feature of all crossarm production is the proper seasoning of the wood from which the crossarms are made. Crossarm timber may ordinarily be either kiln-seasoned or air-seasoned. When properly carried out either method will insure a good product, sound on the inside and relatively free from checks.

Kiln-seasoning, when crowded to save time or when attempted by inadequate equipment or by unqualified operators, usually proves unsatisfactory. A layer of wood cells near the surface will collapse due to the pressure created by the outer shell drying and shrinking while the inside of the crossarm remains saturated and expands with moisture. This condition is termed "case hardening."

The outer layer of the collapsed cells loses its elasticity and the shrinkage practically stops, although the drying may be continued after the case hardening has developed. Eventually the inside of the crossarm drys out and, due to the fact that the outer shell will not shrink

with it, the inner wood fibers separate from one another causing numerous surface openings, termed "honey-combing." These tend to catch and retain moisture, which promotes decay.

Severe exposure to sun and dry wind in air-seasoning will cause the same trouble. The interior honey-combing of the improperly-seasoned arm eventually develops large surface checks which conduct moisture of rains directly to the interior.

Perhaps the most severe condition to which a crossarm may be subjected is when the arm is bored and installed on the pole in an unseasoned condition. This exposes the arm to the sun and the drying effects of winds which will cause the outer shell to dry rapidly and in advance of the interior of the wood. In addition to case hardening and subsequent honey-combing, together with large surface checks, the pin holes tend to shrink and become elliptical; they develop checks if the pins are installed or cause splitting if the pins are forced into the pin holes later.

In most sections of this country the equilibrium moisture content of douglas fir crossarms ranges from 12 per cent to 15 per cent, but engineers have recently learned that crossarms seasoned by correct methods to a content between 12 per cent and 15 per cent (due precautions being taken to avoid moisture gradient of more than 1 per cent or 2 per cent at any stage of the seasoning) will not only be sound and solid in their fibre structure when the arms are installed, but will so remain during long years of service.

New type, one-piece transposition glass insulator.

Crossarm pins are ordinarily made from reasonably straight-grained yellow or black locust, free from knots, checks and other imperfections. Oak is occasionally used for this purpose although locust generally proves more popular due to its hard, close-grained wood, which is impenetrable by moisture and practically impervious to decay. Also, because of its great strength and uniform quality, it is well suited for the making of wood insulator pins where accurate turning and freedom from shrinking or warping are primary considerations.

Telephone type crossarm pins are ordinarily 1¼ inches by 8 inches, a transmission pin 1¼ inches by 9 inches and a duplex pin, which is threaded on both ends so that one insulator can be placed under the crossarm, is 1¼ inches by 11 inches. Pins 1½ inches in diameter are sometimes used but they are not ordinarily considered standard for telephone use.

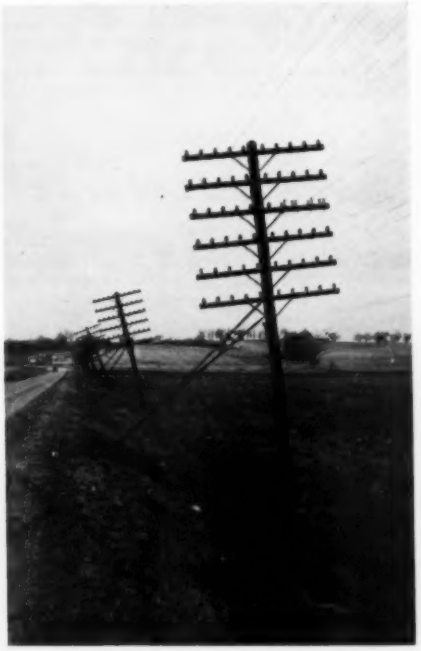
An oak cob with a galvanized steel pin is used quite extensively by some telegraph companies but it has never come into common use for telephone lines. A pin of a similar type is, however, used extensively on drop brackets for transpositions on toll lines.

Side or pole wood brackets are usually manufactured from well-seasoned oak. This type wood eliminates all danger of shrinking after installation. The top section of the bracket is accurately turned to size and threads are cleanly cut. Brackets may be purchased treated, untreated, or painted as the user may prefer.

When clear glass insulators are used with creosoted wood brackets, the inside of the insulators may become stained a dark brown from the creosote boiling out by the heat of the hot sun of summer. From all in-

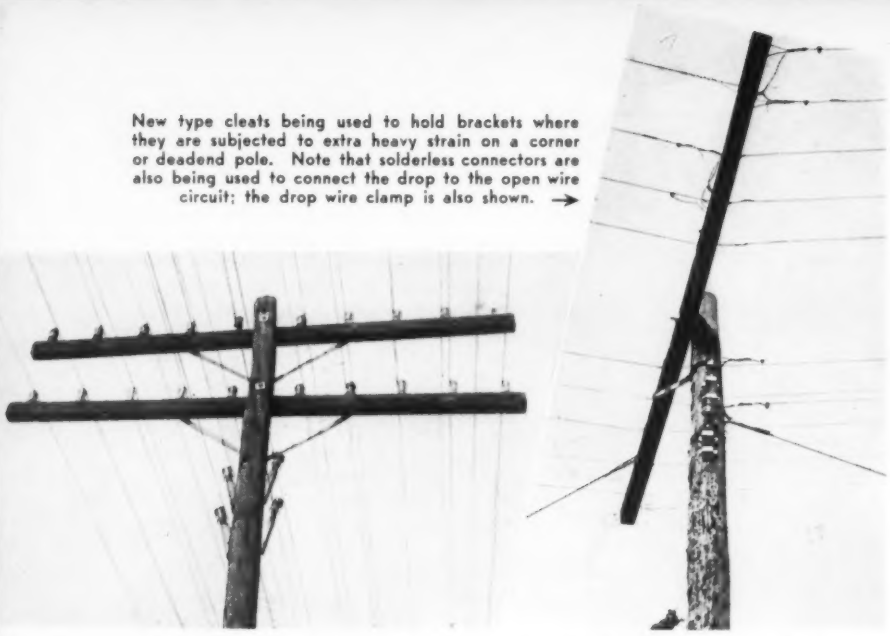
Drop brackets used for transpositions on a toll line. Part of the insulators are of the new clear-glass variety and the remainder are of the old bottle green glass type.

Good poles set to a proper depth easily carry the added load of winter's snow and sleet, even on a heavy toll line.



Being set too shallow, the poles on this heavily-loaded toll line kicked out when forced to carry an extra heavy sleet load on the wires.

New type cleats being used to hold brackets where they are subjected to extra heavy strain on a corner or deadend pole. Note that solderless connectors are also being used to connect the drop to the open wire circuit; the drop wire clamp is also shown. →



↑ When clear glass insulators are installed on creosoted wooden brackets they sometimes become discolored; this, however, does not affect their insulating properties.

dications, however, this does not affect the insulating properties of the glass in the slightest.

Wood brackets are ordinarily attached to poles by nails. Difficulty is frequently experienced in these brackets holding when they must carry an extra heavy load on a corner. This trouble is often effectively eliminated by tying the brackets to the pole with one or more turns of galvanized iron wire. Manufacturers are now supplying a formed cleat, somewhat similar to a pipe strap, which is nailed to the poles over the bracket so that the bracket will safely carry extra loads without loosening.

The crossarm back brace is now used extensively to replace the usual double arm. The brace, ordinarily constructed of angle iron, is drilled for the through bolt in the center and is attached to the crossarm by two ½ inch machine bolts. This brace has practically the same holding power as a double arm and is ordinarily considered satisfactory in the average line. It is also much easier to install and provides much better climbing space on a buck-arm corner.

Pole Hardware

Pole hardware has come in for its share of improvement in design during the past few years. The latest design is known as "static proof" hardware. It is supposed to eliminate considerable radio interference which is largely traceable to loose hardware—that is, hardware assemblies—the various parts of which have become loosened with relation to one another.

The new type hardware combines several parts into a single unit which should result in considerable saving by reducing lost parts and lowering labor costs. A feature of this new type hardware is that it may be completely locked in place by the use of tapped washers and locknuts.

Standard hardware, on ordinary timber, is subject to loosening by vibration; in fact, nuts frequently vibrate completely off the bolts within six months after installation. To correct this fault it is often necessary to retighten hardware, of the regular type, on a pole regularly at least twice each year. This in turn results in an additional hazard, due to the crushing of additional wood fibres each time the hardware is tightened which increases the tendency to induce decay.

The new design effectively provides a bond between all metal parts. This bond is secured by threaded washers and locknuts and has the effect of making the hardware into a one-piece assembly. It consists of only four major items, made up in various sizes and assembled in various combinations for different purposes. They are: the washer head bolt, the washer nut, washer head lag screws, and tapped washers.

Washer head bolts have a standard size head so they may be used as cap screws if necessary. The washer nut has more threads than standard nuts and is, therefore, less subject to loosening by vibration. The

(Please turn to page 55)

Old sawed poles in the line after 35 years of service are still in good condition.→

Pole lines are now often placed a few feet from the pavement along a highway when the highway department will permit such construction. This provides a better line at less cost than placing on the top of a hill. ↓

In the Nation's Capital

by Francis X. Welch

Special Washington, D. C., Correspondent for TELEPHONY

***ANALYSIS** presented of source and strength of support from the House membership for liberalized telephone wage-hour standards . . . State commissioners' association may be represented at hearing on the telephone amendment . . . FCC final report on special telephone investigation progressing slowly . . . Foreign news contains telephone items of interest*

THERE IS a good chance that, by the time these lines are read, Representative Norton's bill to amend the Wage-Hour Law will have its telephone exemption clause increased to include exchanges of 500 stations instead of 350, as originally introduced by Mrs. Norton. This was indicated as a result of meetings which the House labor committee held last week.

Oddly enough, the committee itself seemed disposed to let the bill ride, by an ever so slight margin, in the restricted form in which it was introduced. But the committee members had been hearing from their colleagues on the matter and there was a growing belief that unless the bill were liberalized in the committee, it would be so amended from the floor of the House (thanks to a rules committee which is somewhat more conservative and pro-business than Mrs. Norton's labor committee).

In short, a number of the House labor committee members had been given reason to believe that unless their committee liberalized its own bill, the rules committee might team up with the opposition. Of course, these committee skirmishes have not all been focused on that particular section of Mrs. Norton's bill which has to do with telephone exchange exemptions. The general idea was that if the House labor committee wanted to avoid getting a black eye, it would make a special effort to report a bill more in conformity with the feelings of the House membership.

IT IS INTERESTING to note the source and strength of the support from the House membership for liberalized telephone wage-hour standards. The backbone of the support is in the Middle West and is largely non-partisan — if anything, slightly on the Democratic side.

These members have been hearing from back home and are convinced that the telephone industry needs relief. They are convinced that it is to the advantage and general welfare of their own congressional districts where Independent telephony is more widespread than in other sections of the country) that such relief should be given.

Supporting this middle western group are Republican members from other sections which have been generally disposed to go along with most types of reasonable amendatory legislation to modify the more extreme New Deal measures. However, the Republican leaders have not made a party issue of what is, relatively speaking, a minor legislative phase. This is just as well because it leaves the door wide open for Democrats to come in. And come in they have, unless your correspondent's soundings are erroneous.

Strangely enough, these are the Democrats from the north and central Atlantic coastal areas in which Independent telephone companies are, comparatively speaking, not so numerous. Just for a sample, four out of six Democratic members of the Maryland delegation to the House of Representatives are rumored to be favorably disposed toward liberal relief.

The situation in the Southern states seems to be mixed while the opposition, such as it is, comes mainly from the far western delegations which have always been notably sensitive to labor union influence. One member of this category made a rather sketchy attempt to inject the old anti-utility issue into the picture, presumably on the basis that the old "power bloc" of the House might rally. But the old "power bloc" isn't what it used to be in the 75th Congress. It's only about half of what it used to be.

Anyway, several of the Southern brethren who are willing to do or die for TVA, seemingly failed to see any connection between the proposal to relieve small rural telephone companies from oppressive statutory payroll requirements and the hackneyed power issue. After a couple of timid passes in this direction in the form of telephone calls to members of the House, this idea fizzled out and nothing more is likely to be heard from it.

OVER ON the Senate side, Chairman Thomas is getting his committee on education and labor lined up for a consideration of wage-hour law amendments generally. In view of the fact that the Norris-Thomas bills cover so many topics, hearings on the Senate side may be ordered around the first of May. (Your correspondent doesn't expect final legislative action on this law until about June 1.)

When such hearings are held the National Association of Railroad and Utilities Commissioners may appear in the matter of telephone ex-

change exemptions, through its Washington representative, John E. Benton. While Mr. Benton will probably present only a factual report of the state commissions' attitude (meaning that he will not officially argue for or against the bill), his presentation may throw interesting light upon circumstances surrounding the recent questionnaire on the subject which the Wage-Hour Administrator sent out some weeks ago to the state commissions.

Wage-Hour Administrator Andrews, in a recent statement to the Senate and House labor committees, undertook a very brief explanation of the curious fact that after asking the state commissions what they thought of exempting the small telephone exchanges, and after receiving their advice in the form of replies which indicated a preponderance of support for exemptions of exchanges up to 1,000 subscribers, the Wage-Hour Administration recommended a much lower maximum to the House committee. Mr. Andrews said in part:

"In the course of our study we requested all of the state public service commissions to give us the benefit of their expert opinions as to the desirability and scope of an exemption for telephone companies. The replies indicated that an exemption is necessary to preserve uninterrupted telephone communication service, and a majority suggested an exemption for exchanges having 1,000 subscribers or less.

"We do not recommend this suggested figure of 1,000 because our own independent investigation indicated that a smaller exemption would be adequate in the light of the requirements of the Fair Labor Standards Act, and we had no knowledge of the reasons upon which the opinions were based."

As a matter of fact, most of the state commissions did not volunteer any detailed reasoning because the request of the Wage-Hour Administrator did not specifically ask for such reasoning. It presumably called upon the state commissions for their expert opinion; their qualifications and backgrounds were apparently assumed. Further, most of the state commissions selected the 1,000 maximum for the perfectly obvious reason that it was the only suggestion then before Congress. (This was the figure used in the original Herring-Harrington bills.)

Far from selecting any arbitrary standard, the state commissions reacted in a logical way by passing upon the only concrete proposal which had been made on the subject up to that time. It was the Wage-Hour Administration staff, which figured out the lower maximum figures after replies to the state questionnaires were all in.

However, it is noteworthy that the balance of Mr. Andrews' statement reflects a very sympathetic view of the problem of the Independent industry, and the distinction between employment of operators in small rural exchanges as compared with industrial sweatshop conditions in large cities, which the wage-hour legislation was primarily designed to correct.

OVER AT the FCC things have been more or less quiet along the routine regulatory front. As for extra-routine activity, the final report on the special telephone investigation is still going on slowly and with considerable discussion in the executive sessions of the commission. Of more immediate interest was the release of the second section of the report by a special FCC committee on proposed rules revision. This committee is composed of Commissioners Case (chairman), Craven, and Payne.

A most noteworthy feature of this sectional report was the suggestion that the Federal government may eventually have to take steps to protect newspapers from "unlimited" competition from radio stations. The report said on this point:

"It cannot safely be argued that Congress always will permit radio licenses unlimited opportunity to secure all advertising business to the serious detriment of the economic structure of important and necessary services rendered to the public by unlicensed media."

After reiterating its opposition to so-called super-power broadcast stations (those using more than 50,000 watts in transmission strength), the committee emphasized the widespread economic effect of high-powered stations in part as follows:

"It cannot be concluded safely that if radio competition with other media should be highly successful, the public interest would be served by permitting the economic annihilation of these other media.

(Please turn to page 38)

One Too Many

By ANNE BARNES

Traveling Chief Operator, Iowa Independent Telephone Association, Des Moines, Iowa

"HAVE YOU fifty friends? It is not enough. Have you one enemy? It is too much." Thus goes an Italian proverb.

If you are an operator in a very small telephone exchange, all of your subscribers—including members of their families—should be your friends. If you have one subscriber who is an enemy to anyone in the service, *it is too much.*

It is the height of folly to make either personal enemies or enemies for your company. In an unguarded moment, you may yield yourself or your company to a subscriber of revengeful nature. By so doing, you are likely to give such a subscriber just the opening he has been hoping for. So, strive constantly to avoid making enemies; and lose no opportunity to make a friend.

It is difficult to know what starts a subscriber off on the wrong foot, but it should be your aim to find out what is wrong from his viewpoint. But do not prod a sore spot tactlessly.

In the words of Longfellow, "If we could read the secret history of our enemies, we should find in each man's suffering enough to disarm all hostility."

As you sit at your little one-position switchboard, you would feel only kindness and sympathy if you could read the secret history of some of your seemingly unreasonable subscribers. You cannot know what went on just before a subscriber's signal reached you.

So, the thing to do when you think you may have made an enemy for yourself, or your company, is to try to *reconcile* him rather than to *conquer* him. The conquered enemy bides his time, and then he is at your throat again. The reconciled enemy becomes an understanding friend.

MORAL: *One enemy among your subscribers is one too many.*

☛ *SALIENT POINTS to be considered in*

Overhead Structural Designs

By JOHN W. WOPAT

Consulting Engineer, Fort Wayne, Ind.

IT IS NOT the purpose, in this discussion, to present a complete treatise on design of overhead structures, but to point out, in general, certain salient points that are sometimes overlooked, unknown, or just left to chance. The assumed loading conditions are those that are used in the National Electrical Safety Code, fourth edition. There is, in the minds of some engineers, the idea that these assumptions are erroneous or do not properly apply. It is not the purpose here to take issue on that point, but to accept them. Time will tell if better values can be found.

In designing a building the services of a competent architect are sought because the owner is afraid to trust his judgment in the elements of structural design of a building; also, because if it is a public building, many states have passed laws as to the safety of such structures.

What are the procedures with respect to the overhead system? Usually they are left to the judgment of the construction foreman with little or no regard for the mechanical engineering problem involved.

If the line is of insufficient strength, it soon falls down and is replaced. If the line is built with excess strength, the error is never known. If the line is built too light, the falling of the line causes unnecessary expense due to its short life and undue interruption of service. If the line is over-built, the investment is greater than necessary and is not justified by the revenue the service produces.

The first requirement in the design of a pole line is to determine the load a line must carry: number and size of wires, and the assumed weather loading (whether the line is in heavy, medium or light sleet area) and grade of line to be built. With this fundamental assumption and with certain known engineering data, a proper design can be built into a pole line, i.e. span length, and class of poles to be used for any assumed loading.

Throughout the United States there are various weather conditions such as sleet and wind. So, for simplification the United States has been zoned into three areas of assumed loading conditions:

Loading

Heavy loading—.5″ radial ice; wind pressure 8 lbs. per ft.

Medium loading—.25″ radial ice; wind pressure 8 lbs. per ft.

Light loading—0 radial ice; wind pressure 12 lbs. per ft.

When designing a pole line it is very essential to determine the loading area; this can be done from experience or by consulting the U. S. Bureau of Standards Safety Code Hand Book. While the hand book makes certain allocations of loading areas—these usually being by states—it is advisable to temper this by local experience; for example, New York state is in a heavy loading area and does have very heavy ice conditions, but Long Island never had a sleet storm.

This is also true in Tennessee and Kentucky; these states are in the heavy loading area. In both states the eastern and western sections are often visited by heavy sleet conditions, while there are certain sections in the central area that never have sleet. So, before arriving definitely as to the assumed loading, make a search to see whether the area is heavy, medium or light loading.

Fiber stresses of different timbers have been determined and approved by the American Standards Association and are given as follows:

	Ultimate Fiber Stress per Sq. In.
Northern white cedar	3,600
Western red cedar	5,600
Chestnut	6,000
Lodge pole, pine	6,600
Douglas fir (creosoted)	7,400
Southern yellow pine (creosoted)	7,400
Norway pine (red pine)	*5,600
Cypress	*4,800
Redwood	*4,400

*Not approved by A.S.A.

With the foregoing allowable fiber stresses and the application of the classical formula, the breaking load for the different classes of poles can be determined as shown in the following table:

Class	(R)
1	4,500
2	3,700
3	3,000
4	2,400
5	1,900
6	1,500
7	1,200
8	*1,200
9	*1,000
10	*800

*Not approved by A.S.A.

Estimated breaking load on taper.

$$R = \frac{.0002638\ f\ (C)^2}{L - d - 2}$$

L = Length
d = Depth setting
C = Circumference at ground line in inches
f = Fiber strength

This may seem academic, but men have often said that a pine pole is stronger than a cedar pole of the same class; this is not true. Poles of the same class have the same resisting moment irrespective of the kind of timber. The American Standards Association's standard measurements for wood poles are built on the basic principle of equiva-

JOHN W. WOPAT, of Fort Wayne, Ind., has presented in the article on this and following pages the substance of stereopticon addresses which he presented at the Michigan and Illinois conventions. It contains valuable data not readily available to the average telephone man.

lent class strength regardless of species. The difference in fiber stress is compensated by diameter and taper requirements.

It is recommended that at all times class poles be bought because of their known and uniform strength, and that poles be properly treated with approved wood preservatives. The use of untreated timber should never be subscribed to.

There are several grades of construction, depending upon location, i.e., crossing, joint construction, conflicts, etc. Where different grades of construction should be employed is covered in the Bureau of Standards National Electrical Safety Code, so that discussion will be omitted. However, where there are crossing conflicts or joint construction refer to the code for the proper grade of construction; this is an important safety measure.

LOADING factors which should be considered before proper design can be built into a pole line. Need for periodic inspection of pole lines, viewing the line as a structure and not as so many poles. Two types of stress imposed on the wire load. Specifications for sags and spans for various types of wire. Importance of determining the loading area in which a line is to be erected. Facts of cable sheath crystallization

Pole lines, as far as practical, should be built for the assumed loading. After a line is built, it should not be forgotten until it falls down; if it is, there is serious interruption of service and the replacements are usually made under severe and adverse weather conditions, frozen ground and tangled wires. This is a very expensive process.

Pole lines should be periodically inspected; and poles that have deteriorated beyond their safe carrying capacity, should be replaced. Poles that have deteriorated to 25 per cent of their ultimate strength should either be replaced or stubbed to restore them to their original strength.

Pole lines should be viewed as a structure and not as so many poles. Often a line fails, not because the line as a whole has deteriorated to 25 per cent of its ultimate strength requirement, but because certain of the members failed and introduced undue stress on the remaining structure.

Pole lines must carry the wire load. Wire imposes on a pole, stress in two directions: vertical load due to the weight of the wire and ice under sleet conditions, and a horizontal load due to wind. Ice weighs 57 pounds per cubic foot; a 60-mile wind exerts a horizontal pressure of eight pounds per square foot of projected area.

Thus, a .109 iron wire under heavy loading conditions—½" radial ice—weighs per foot: wire .032 pound, ice, .3785 pound, a total of .4105 pound. The transverse force due to wind on projected area is .73936 pound per foot. Since of these two forces one is vertical and the other horizontal, the two must be resolved into one component force which, in this case, is .846 pound per foot.

The accompanying tables give values for other sizes commonly used in telephone construction and in heavy loading area.

The proper installation of aerial cable is very important. When inspecting aerial cable installations one is at once impressed as to how well and also how terribly cables may be installed by well-meaning individuals. If these same persons are asked why they pull the cable so tight, or leave it very slack, strange reasons are given.

The following discussion is not a

Heavy Loading,
.5" radial thickness of ice and 8 lbs. pressure

Kind of Wire and Size	A Weight Ice per Ft.	B Weight Wire per Ft.	C Dia. of Wire and Ice in Ft.	D Vertical Force per Ft.	E Transverse Force per Ft.	F Resultant Force per Ft.
Copper						
.080	.3606	.01937	.09000	.37997	.72	.814
.081	.3613	.01977	.09008	.38107	.72064	.815
.102	.3741	.03143	.09183	.40553	.73864	.840
.104	.3756	.03274	.09200	.40834	.736	.842
.128	.3905	.04959	.09400	.44009	.752	.872
.165	.4136	.08241	.09708	.49601	.77664	.922
Iron						
.083	.3623	.019	.09025	.3813	.722	.817
.109	.3785	.032	.09242	.4105	.73936	.846
.134	.3942	.049	.09450	.4432	.7560	.876
.165	.4136	.074	.09750	.4876	.7766	.917

Medium Loading,
.25" radial thickness of ice and 8 lbs. pressure

Copper						
.080	.10255	.01937	.04833	.12192	.38664	.405
.081	.10290	.01977	.04841	.12267	.38728	.406
.102	.10946	.03143	.05017	.14089	.40136	.425
.104	.11001	.03274	.05033	.14275	.40264	.427
.128	.1171	.04959	.05233	.16710	.41864	.454
.165	.12902	.08241	.05542	.21143	.44336	.498
Iron						
.083	.10348	.019	.04858	.12248	.38864	.407
.109	.11162	.032	.05075	.14362	.40600	.43
.134	.11936	.049	.05283	.19836	.42264	.467
.165	.12902	.074	.05542	.20302	.44336	.487

Light Loading,
No ice

						Loading Factor 2	
Copper							
.080	.....	.01937	.00667	.01937	.08004	.0823	.1646
.081	.....	.01977	.00675	.01977	.08100	.0835	.1670
.102	.....	.03143	.0085	.03143	.10200	.1067	.2134
.104	.....	.03274	.00867	.03274	.10404	.1091	.2182
.128	.....	.04959	.01067	.04959	.12804	.1375	.275
.165	.....	.08241	.01375	.08241	.16500	.1845	.369
Iron							
.083	.....	.019	.00692	.019	.08304	.0852	.1704
.109	.....	.032	.00908	.032	.10896	.1136	.2272
.134	.....	.049	.01117	.049	.13404	.1415	.2830
.165	.....	.074	.01375	.074	.16504	.1810	.3620

$E = 8\ C$ for heavy and medium loading

$E = 12C$ for light loading

$F = V\overline{d^2 + E^2}$

Stresses in pounds per foot of conductor

specification but an attempt to point to what happens when certain things are done and why, if cable is not properly installed, it will soon develop trouble. The stock answer, of course, is that it crystallized—but why? So, it is the purpose in this discussion to point out some of the causes of this trouble.

Why does lead-covered cable crystallize? There are two principal reasons: (1) vibration and (2) bending. Lead is a metal which should be used only under quiescent conditions because of the readiness with which it crystallizes and cracks under repeated bending.

Lead cables hung from steel messengers are constantly moving on the messenger because of temperature changes. Unquestionably, therefore, because of these movements aerial cables are subjected to bending. The degree of such bending is dependent upon several factors: Tension under which messenger is strung, daily range of temperature changes, and coefficient of expansion of cable and messenger.

Tests have been made on lead cables hung in rings to determine the number of movements necessary to break the cable sheath in an average dip. A number of pieces of various sizes of cables were bent with a dip of four inches and subjected mechanically to a movement of one inch along the cable.

When the movement was made by a fast-arm motion, it was found that 50 to 100 movements were required to break the sheath of the cable. When the movements were very slowly executed by the arm, it took from 200 to 300 movements to crack the sheath.

The cables with the large diameter were the first to break. This was to be expected, since the angular opening at the surface of the sheath for a given movement would be larger because of the increased value of the radii:

Coefficient of expansion, cable is .0000165 per degree Fahr.

Coefficient of expansion, messenger is .00000678 per degree Fahr.

Coefficient of expansion means that any length expands that fraction of itself for a rise in temperature of one degree. For example, 1000 feet of cable will expand 1000 × .0000165 = .0165 feet for each degree Fahr.; for 100 degrees Fahr. it will expand 1.65 feet.

When we speak of coefficient of expansion of cable, we must bear in mind that we are not dealing with an element, nor even a homogeneous

Heavy Loading Area

Span in Feet	Class of Pole 1	2	3	4	5	6	7	8	9	10
100	52.9	43.5	35.3	28.2	22.3	17.6	14.1	14.1	11.7	9.4
110	48.4	39.8	32.2	25.8	20.4	16.1	12.9	12.9	10.7	8.6
120	44.5	36.6	29.7	23.8	18.8	14.8	11.9	11.9	9.9	7.9
130	40.9	33.6	27.3	21.8	17.3	13.6	10.9	10.9	9.1	7.3
140	38.2	31.3	25.4	20.3	16.1	12.7	10.2	10.2	8.5	6.7
150	35.4	29.1	23.6	18.9	15.0	11.8	9.4	9.4	7.9	6.3
160	33.3	27.4	22.2	17.8	14.1	11.1	8.9	8.9	7.4	5.9
170	31.2	25.7	20.8	16.7	13.2	10.4	8.3	8.3	6.9	5.5
180	29.6	24.3	19.7	15.8	12.5	9.9	7.9	7.9	6.6	5.2
190	27.9	23.0	18.6	14.9	11.8	9.3	7.4	7.4	6.2	4.9
200	26.6	21.9	17.7	14.2	11.2	8.9	7.1	7.1	5.9	4.7
220	24.2	19.6	16.1	12.9	10.2	8.1	6.4	6.4	5.4	4.3
240	22.2	18.2	14.8	11.8	9.3	7.4	5.9	5.9	4.9	3.9
260	20.4	16.8	13.6	10.9	8.6	6.8	5.4	5.4	4.5	3.6
280	19.0	15.6	12.6	10.1	8.0	6.3	5.1	5.1	4.2	3.3
300	17.7	14.6	11.8	9.4	7.5	5.9	4.7	4.7	3.9	3.1
350	15.2	12.5	10.1	8.1	6.4	5.1	4.0	4.0	3.4	2.7
400	13.3	10.9	8.8	7.1	5.6	4.4	3.5	3.5	2.9	2.3
450	11.8	9.7	7.8	6.3	5.0	3.9	3.1	3.1	2.6	2.1

Note: Number of wires above line may be increased by 33 per cent due to shielding.

Medium Loading Area

Span in Feet	1	2	3	4	5	6	7	8	9	10
100	100.5	86.5	69.8	55.4	44.2	34.9	27.9	27.9	23.2	18.6
110	95.2	78.3	63.4	50.4	40.2	31.7	26.8	26.5	21.1	16.9
120	87.2	71.7	58.2	46.5	36.8	29.1	23.2	23.2	19.3	15.5
130	80.5	66.2	53.7	42.9	34.0	26.8	21.4	21.4	17.8	14.3
140	74.7	61.4	49.8	39.8	31.6	24.9	19.9	19.9	16.6	13.2
150	69.7	57.4	46.5	37.4	29.4	23.2	18.6	18.6	15.5	12.4
160	65.4	54.7	43.6	34.9	27.6	21.8	17.4	17.4	14.5	11.6
170	61.5	50.6	41.1	32.8	26.0	20.5	16.4	16.4	13.6	10.9
180	58.1	47.6	38.7	31.0	24.5	19.3	15.5	15.5	12.9	10.3
190	55.1	45.3	36.7	29.3	23.2	18.3	14.7	14.7	12.2	9.8
200	52.3	43.0	34.8	27.9	22.1	17.4	13.9	13.9	11.6	9.3
220	47.6	39.2	31.7	25.3	20.3	15.8	12.6	12.6	10.5	8.5
240	43.6	35.8	29.1	23.2	18.4	14.5	11.6	11.6	9.7	7.7
260	40.6	33.4	27.1	21.6	17.0	13.4	10.7	10.7	8.4	7.1
280	37.4	30.7	24.9	19.9	15.8	12.4	9.6	9.6	8.3	6.2
300	34.8	28.6	23.2	18.5	14.7	11.6	9.3	9.3	7.7	6.6
350	29.7	24.4	19.8	15.8	12.6	10.0	7.9	7.9	6.1	5.3
400	26.1	21.5	17.4	13.9	11.0	8.7	6.9	6.9	5.8	4.6
450	23.2	19.1	15.5	12.4	9.8	7.7	6.2	6.2	5.1	4.1

Note: Number of wires above line may be increased by 33 per cent due to shielding

Light Loading Area

Span in Feet	Class of Poles 1	2	3	4	5	6	7	8	9	10
100	264	227	176	141	111	80	70	70	58	47
110	240	198	160	128	101	80	64	64	53	42
120	220	181	147	117	93	73	59	59	49	39
130	204	168	136	109	86	68	54	54	45	36
140	189	155	126	101	80	63	50	50	42	33
150	175	144	116	93	74	58	46	46	39	31
160	165	135	110	87	69	55	44	44	36	29
170	155	127	103	82	65	51	41	41	34	27
180	146	120	97	78	61	48	39	39	32	26
190	137	113	91	73	58	45	36	36	30	24
200	132	107	88	70	55	44	35	35	29	23
220	120	98	80	64	50	40	32	32	26	21
240	114	90	73	58	46	36	29	29	24	19
260	101	83	67	54	43	33	27	27	22	18
280	94	77	62	50	39	31	25	25	21	16
300	87	72	58	47	37	29	23	23	19	15
350	75	62	50	40	31	25	20	20	16	13
400	66	54	44	36	27	22	17	17	14	11
450	58	48	29	31	24	19	15	15	13	10

No shielding in light loading area. Loading factor 2.

Number of .109 wires safe load according to class and span

mass, but with a group of dissimilar things. Cable will expand differently under different conditions. If the pairs are cut clean and the cable capped, we get a different value than if the pairs are sweated to the sheath. The latter condition is what is realized in practice, due to taps and splices. The sheath and the copper wire must, to a large degree, expand together.

One would expect to find a different coefficient of expansion for different sizes of cable. The values are so close together that, for all intents and purposes, they are within the observed differential, as will be noted below:

25-pair 22 gauge	.0000155° Fahr.
50-pair 22 gauge	.0000159° Fahr.
100-pair 22 gauge	.0000166° Fahr.
200-pair 22 gauge	.0000157° Fahr.
300-pair 22 gauge	.0000161° Fahr.
400-pair 22 gauge	.0000164° Fahr.
600-pair 22 gauge	.0000165° Fahr.
200-pair 19 gauge	.0000158° Fahr.
300-pair 19 gauge	.0000158° Fahr.
Mean average of all determinations	.0000165° Fahr.

The variations between the expansion, with messenger under zero tensions and cable for a 110-foot span is shown graphically in Fig. 1.

This movement of the lead cable will be readily understood by refering to its coefficient of expansion as found; in other words, for any given change in temperature a lead sheath will expand about 2½ times as much as a steel messenger. In a 110-foot span, for instance, with a rise of 100 degrees Fahrenheit, a lead-covered cable will increase its length 2.13 inches while the steel messenger will increase only .84 inch, leaving a surplus of 1.29 inches of lead cable, which obviously must be stowed away somewhere.

The cable, by reason of its excessive expansion, is forced into taking care of itself by moving into pole dips or other bends or kinks along the cable. If the cable were free to move through its entire length and were placed on frictionless rollers, it would expand in a straight line and not into dips or bends along the length of the cable.

These dips or bends may be called nodes of least resistance, with which the cable moves back and forth with every temperature variation. Naturally, these daily excursions of the cable into the dips and bends will in time cause deterioration in the cable sheath and finally result in crystallization and cracking.

Realizing then that there is a difference in expansion rates between

(Please turn to page 42)

Span in Feet	Size of Wire .080	.102	.104	.128	.165	.083	.109	.134	.165
				Heavy Loading Area					
100	81.4	84.0	84.2	87.2	92.2	81.7	84.6	87.6	91.7
110	89.6	92.4	92.6	96.0	101.5	89.8	93.0	95.4	100.9
120	97.7	100.9	101.0	104.8	110.8	98.2	101.5	105.2	110.1
130	105.8	109.2	109.5	113.4	120.0	106.3	110.0	113.9	119.3
140	114.0	117.6	117.9	122.3	129.2	114.5	118.5	122.6	128.4
150	122.1	126.0	126.4	130.9	138.5	122.6	127.0	131.5	137.5
160	130.2	134.5	134.7	139.6	147.6	130.9	135.4	140.2	146.6
170	138.3	142.9	143.1	148.4	156.9	139.0	143.8	149.0	156.0
180	146.5	151.2	151.5	157.0	166.0	147.0	152.4	157.6	165.1
190	154.4	159.7	160.0	165.7	175.3	155.3	160.8	166.5	174.3
200	162.8	168.0	168.4	174.5	184.5	163.4	169.3	175.2	183.4
220	179.0	184.9	185.2	192.0	203.0	179.8	186.2	192.6	201.9
240	195.4	201.8	202.0	209.4	221.4	196.0	203.1	210.2	220.0
260	211.5	218.4	219.0	226.9	240.0	212.5	220.0	228.0	238.3
280	228.0	235.2	235.8	244.2	258.3	228.9	237.0	245.2	256.9
300	244.0	252.0	252.6	261.8	276.8	245.0	254.0	262.9	275.2
350	285.0	294.0	294.8	305.5	322.9	286.0	296.1	306.5	321.0
400	325.5	336.0	336.8	349.0	369.0	327.0	338.4	350.4	367.0
450	366.0	378.0	379.0	392.5	415.0	367.5	380.8	394.0	412.8
				Medium Loading Area					
100	40.5	42.5	42.7	45.4	49.8	40.7	43.0	46.7	48.7
110	44.5	46.7	47.0	49.9	54.8	44.8	47.3	51.4	53.6
120	48.6	51.0	51.2	54.5	59.8	48.8	51.6	56.0	58.4
130	52.6	55.2	55.5	59.0	64.7	52.9	55.9	60.7	63.3
140	56.7	59.5	59.8	63.6	69.7	57.0	60.2	65.4	68.2
150	60.8	63.7	64.0	68.1	74.7	61.0	64.5	70.0	73.0
160	64.9	68.0	68.3	72.6	79.7	65.1	68.8	74.7	77.9
170	68.8	72.2	72.6	77.2	84.7	69.2	73.1	79.4	82.8
180	72.9	76.5	76.9	81.7	89.6	73.3	77.4	84.1	87.7
190	77.0	80.7	81.1	86.3	94.6	77.3	81.7	88.7	92.5
200	81.0	85.0	85.4	90.8	99.6	81.4	86.0	93.4	97.4
220	89.2	93.5	93.9	99.9	109.6	89.5	94.6	102.7	107.1
240	97.2	102.0	102.5	109.0	119.5	97.7	103.2	112.1	116.9
260	105.4	110.5	111.0	118.0	129.5	105.8	111.8	121.4	126.6
280	113.5	119.0	119.6	127.1	139.4	114.0	120.4	130.8	136.4
300	121.6	127.5	128.1	136.2	149.4	122.1	129.0	140.1	146.1
350	141.9	148.7	149.4	158.9	174.3	142.4	150.5	163.4	170.4
400	162.3	170.0	170.8	181.6	199.2	162.8	172.0	186.8	194.8
450	182.4	191.2	192.1	204.3	224.1	183.1	193.5	210.1	219.1
				Light Loading Area, Loading Factor 2					
100	16.4	16.7	21.34	21.82	27.5	36.9	17.04	22.72	28.30
110	18.1	18.4	23.47	24.00	30.2	40.6	18.7	25.0	31.1
120	19.7	20.0	25.61	26.18	33.0	44.3	20.4	27.3	34.0
130	21.3	21.7	27.74	28.37	35.7	48.0	22.2	29.5	36.8
140	23.0	23.4	29.88	30.55	38.5	51.7	23.8	31.8	39.6
150	24.6	25.0	32.01	32.73	41.2	55.3	25.6	34.1	42.5
160	26.2	26.7	34.14	34.91	44.0	59.0	27.3	36.3	45.3
170	27.9	28.4	36.28	37.09	46.7	62.7	29.0	38.6	48.1
180	29.5	30.1	38.41	39.28	49.5	66.4	30.7	40.9	50.9
190	31.2	31.7	40.55	41.46	52.3	70.1	32.3	43.2	53.8
200	32.8	33.4	42.68	43.64	55.0	73.8	34.1	45.4	56.6
220	36.1	36.7	46.95	48.00	60.5	81.2	37.5	50.0	62.3
240	39.4	40.1	51.22	52.37	66.0	88.6	40.9	54.5	67.9
260	42.6	43.4	55.48	56.73	71.5	95.9	44.3	59.1	73.6
280	45.9	46.8	59.75	61.19	77.0	103.3	47.7	63.6	79.2
300	49.2	50.1	64.02	65.46	82.5	110.7	51.1	68.2	84.9
350	57.4	58.4	74.69	76.36	96.3	129.1	59.6	79.5	99.1
400	65.6	66.8	85.36	87.28	110.0	147.6	68.2	90.9	113.2
450	73.8	75.1	96.03	98.19	123.7	166.0	76.7	102.2	127.3
				No Loading Factor					
100	8.2	10.6	10.9	13.7	18.4	8.5	11.3	15.2	18.1
110	9.0	11.7	12.0	15.1	20.2	9.3	12.4	16.7	19.9
120	9.8	12.7	13.1	16.4	22.1	10.2	13.6	18.2	21.7
130	10.7	13.8	14.2	17.8	23.9	11.0	14.7	19.8	23.5
140	11.5	14.8	15.3	19.2	25.8	11.9	15.8	21.3	25.3
150	12.3	15.9	16.3	20.5	27.6	12.7	16.9	22.8	27.1
160	13.1	17.0	17.4	21.9	29.4	13.6	18.1	24.3	29.0
170	13.9	18.0	18.5	23.3	31.3	14.5	19.2	25.8	30.8
180	14.8	19.1	19.6	24.7	33.1	15.3	20.3	27.4	32.6
190	15.6	20.1	20.7	26.0	35.0	16.1	21.5	28.9	34.4
200	16.4	21.2	21.8	27.4	36.8	17.0	22.6	30.4	36.2
220	18.0	23.3	24.0	30.1	40.5	18.7	24.8	33.4	39.8
240	19.7	25.4	26.2	32.9	44.2	20.4	27.1	36.5	43.4
260	21.3	27.6	28.3	35.6	47.8	22.1	29.4	39.5	47.1
280	23.0	29.7	30.5	38.4	51.5	23.8	31.6	42.6	50.7
300	24.6	31.8	32.7	41.1	55.2	25.5	33.9	45.6	54.3
350	28.7	37.1	38.2	47.9	64.4	29.8	39.5	53.2	63.3
400	32.8	42.4	43.6	54.8	73.6	34.0	45.2	60.8	72.4
450	36.9	47.7	49.1	61.6	82.8	38.2	50.8	68.4	81.4

Resultant force of one wire in pounds

☛ *PLANT EMPLOYE urged to bear in mind the far-reaching results of his work upon the major problem of providing good service*

Plant Construction Methods

By MILTON P. NAAB

General Construction Supervisor, Wisconsin Telephone Co.

A DISCUSSION of outside telephone plant construction methods should be preceded by an analysis of the necessity for a construction job. If we study the telephone business we find that the entire outside plant is used to provide wire communication service.

Telephone service is generally divided between toll—that service which provides communication between communities or exchange areas—and local, that service which provides communication within a community or exchange area. Because of the universal use of telephone service, it is essential that each telephone and its connecting lines be constructed so that any possible overall connection will be of good volume and quality.

It may be necessary to connect any local telephone in Wisconsin with one across the continent in California—yes, possibly halfway around the world. Therefore, regardless of the type of service it should be efficient, it should be economical, and it should be as nearly uninterrupted as possible.

To obtain these results it is desirable, before any construction work is started, that such contemplated work should fit in with plans for the outside plant. A plan of the ultimate telephone plant should be prepared, bearing in mind that future additions will be required for growth and that each new part should, when constructed, be a logical and proper continuation of existing plant.

In preparing such a plan, study must be given to the probable direction and extent of growth, the number of subscribers which under normal conditions may be expected, and the type of service which they will require.

The location of outside plant with reference to private property, alleys, or streets and highways should be studied. The location of the plant must also be considered with reference to the plant of other utilities so as to avoid conflicting construction. Where it is feasible, joint construction should be used or, if separate plants are to be maintained, proper locations for each plant must be planned.

With the foregoing in mind let us see what part the outside plant plays in the picture of wire communication. We will find in general that the outside plant is the connecting link between switchboards and between switchboards and telephones. It is the part of the property which is exposed to the changing conditions of the weather and to the hazards of the elements.

If improperly planned or poorly built it may be unable to withstand the ordinary action of the elements, or it may result in unnecessary and early high maintenance costs, or may by failure cause interruption to the entire system. In fact, it may be the weakest link in the chain.

The construction of outside plant should take into consideration the future maintenance of that plant, for there is no fine dividing line between maintenance and construction. The division is usually dependent upon the extent of the maintenance work. For example, replacement of pins and insulators is generally termed maintenance; while on the other hand replacement of poles or crossarms is generally termed construction.

It is conceivable that a plant might be built so well that it would require little, if any, maintenance during its entire life. However, such a plant may be prohibitive in cost so that probably the best construction methods are those which spend the construction dollar for the type of construction that will provide good, economical, uninterrupted service with a reasonable amount of future maintenance costs.

The problem resolves itself into building a plant tnat can be kept in good working order for a relatively long period of time at a minimum total cost for construction and maintenance. To build such a plant certain standards of construction have to be set up and followed by the various wire-using companies.

It has been recognized that each step of the parts which go to make up a telephone plant is subject to various loads and stresses; and if the combined plant is to provide efficient, economical and uninterrupted service, each of the parts must be built strong enough to withstand the forces which may be exerted upon it.

If, for example, when a pole line is built, a corner pole of sufficient strength to support its maximum load and a down guy strong enough to hold the pull are installed with an anchor which is too small or has not been placed at the proper distance from the pole—or the pole itself has not been set to the proper depth, the tamping done in a good manner, and the pole given a proper rake—it probably will be necessary to do the job over again long before the normal life of the pole and guy has been realized.

If any of the parts of the combined plant are built much stronger than

***NECESSITY** for a particular construction job should be analyzed before planning the work and deciding upon the methods by which it is to be executed. Problem is one of building plant that will give good service over a relatively long period of time at a minimum construction and maintenance cost. . . . Why standards of construction have been developed. Forethought and planning on the smallest job should be productive of economy, better workmanship and provide for safety of manpower assigned to the task. . . . Address before the annual convention of the Wisconsin State Telephone Association*

the rest of the plant, money has been wasted because the failure of any of the weaker parts will not permit obtaining the expected life from the stronger parts.

The efficient plant is one in which a balance of strength has been maintained throughout the entire structure. It is for the purpose of providing this balance that standards of construction have been developed; and it follows that good plant construction should follow the recommended standards.

As experience with the various types of outside plant increases, changes in construction standards are desirable; however, it should be borne in mind that these changes and improvements should usually be applied gradually, as opportunity offers, through the requirements for new plant due to growth, changes and maintenance replacements.

Before proceeding with a particular piece of construction work, the plans should be consulted. These plans should show the territory to be covered and the present and possible future subscribers with types of service plotted, and from this the type of plant should be determined.

In urban areas where cable distribution is employed, proper terminal distribution must be studied and the location of the cable as to alleys, private property, or streets determined, preference being given to locating pole and cable plant in alleys or on rear lot lines.

In rural areas it is common practice to follow the highways, because the use of the highways provides a location that is accessible and gives an opportunity for good distribution; but it must be borne in mind that, due to the fact that these highways are used primarily for travel, the locations of poles should be considered relative to the traveled portion of the road, ditches, and possible future highway improvements.

Clearance from trees, both on the highway and adjacent property, must be considered. In many instances private property locations just off the highway have advantages.

The detail plan should cover the size, type, and kind of poles to be placed. It should show the size and gauge of cable to be used or, if open wire is to be used, the size and kind of wire and pin positions should be indicated. Type and kind of crossarms should also be shown. In addition to the foregoing, any special construction features not covered by standard practices should be worked out in detail.

Where underground conduit is to be constructed, detailed locations in streets, alleys, or on private property of other underground structures, curbs, sidewalks, etc., should be shown. Manhole locations and sizes should be shown in detail. Types of conduit and material for manholes should be indicated.

When the necessary plans have been completed and the routes settled, you are up to the point of actually performing the work. At this stage there is an opportunity for good judgment and forethought to effect economies and secure good construction.

The job may be a fairly large one, covering a substantial portion of your exchange area, it may be merely the moving of a line of poles a short distance, or it may consist of placing one pole; but any of them should receive a proportionate amount of study and intelligent and practical planning of the actual work—how large a crew, how well the work fits in with the other work you have, at what point you will need the material, what shipping dates are required or have you the material on hand, and what, if any, power equipment can be used economically.

In this study, naturally, the time factor enters. Is it a job where the service demands prompt completion? Or is it a job along the line of general improvement, which may be fitted into your construction program to be done in the most economical manner at the most opportune time?

But the point I want to emphasize is that no matter how small the job is, it may be improved by forethought. This will not only prove economical and result in better work, but may provide for safety. Any construction program which does not contemplate and take into consideration the safe working conditions of the manpower is lacking in a major essential.

On construction jobs it is desirable to schedule the work in such a way that the various parts making up the entire job will be started at certain times and have definite completion dates. For various reasons you may not always be able to carry out such a schedule; but you will find that it makes a more orderly program. It should facilitate the planning for the need and location of material and equipment, and it should provide a better allocation of manpower.

It surely will provide a ready check of the progress of the job. As far as the workmen are concerned you will find that an occasional check-up, on what you might call the working score, will be welcomed by the right kind of a mechanic and will develop in him an interest in his work and the progress of the job.

The setting of poles always forms a large portion of our construction work. In general, holes are dug and poles are placed by hand. Recently power equipment has come into use where sometimes, when the occasion warrants, earth-boring machines, derricks, and winches prove an advantage. While the type of tools and methods may vary between the larger companies and the smaller ones, the importance of the well-constructed piece of plant does not vary. It is just as important that the one pole set by the smaller company be done in just as good a manner as a large number of poles placed by a large company.

In pole replacement work the new pole is very often set next to the old pole or, as frequently is done, the old pole is cut off, moved over, the old butt removed with a pole jack and the new pole set in the enlarged old hole.

Closely related to poles are crossarms or brackets, and the placing of these should be considered along with the erection of the poles. Crossarms or brackets may be placed before the pole is erected. This method, if followed on a working line, must naturally be used more carefully than where it is a new line.

After the equipped poles are in place, the open wire or cable may be attached. If open wire is used, up to ten wires placed on a ten-pin crossarm can be pulled-in at one time by means of a wire-running board and truck. Fewer wires are handled in a similar manner. However, transpositions should be thrown in as the wire is pulled. This avoids the necessity of cutting the wire later, eliminates splices, and saves time.

The pulling of wire should be done

(Please turn to page 52)

The Best Story of the Week —What's Yours?

In Columbus, Ohio, last Friday, sheriff's deputies were sent to an outlying section on a report that a man was "butting his head against a telephone pole."

"And he has been doing it for about an hour," the complainant told Chief Deputy Ralph G. Garner.

Investigators found the man to be a WPA worker making a traffic survey. He was near-sighted, the deputies said, and had to lean his head against the pole to write on his chart.

ANNUAL CONVENTION of Missouri Telephone Association shows

Missourians Alert to Happenings

NEVER BEFORE has a meeting of the Missouri Telephone Association held the interest and attention of everyone present to such an extent as this year's convention, held April 3 and 4 at Hotel Muehlebach, in Kansas City, Mo. This was the observation of Secretary R. W. Hedrick, of Jefferson City, in reflecting upon this year's annual get-together. There was a registration of about 350 names and every convention session had a good attendance.

All exhibit space available was taken, approximately 20 different concerns being represented. The exhibits presented this year were among the best in the association's history.

A. M. Benedict, manager of the Richards Telephone Co., was elected president of the association to succeed E. F. Carter, vice-president and general manager of the Missouri Telephone Co., Columbia, who has served as chief executive of the association for two terms. J. R. Carter, of Perry, was chosen first vice-president; W. R. Journey, of Higginsville, was re-elected second vice-president; J. M. Roberts, of Gallatin, was elected third vice-president to succeed T. R. Schweer, of Rolla; and Elmer Weakley, of Plattsburg, was re-elected fourth vice-president. R. W. Hedrick, of Jefferson City, was re-elected secretary and treasurer by the executive committee.

The association re-elected to the executive committee the following three directors whose terms had expired: Foster McHenry, Jefferson City; S. T. Neill, Clinton, and C. W. Boutin, Cape Girardeau. The holdover members follow: George Hearne, Warrensburg; Carl L. Spaid, Clinton; C. A. Ulffers, Kansas City; C. A. Vedder, St. Louis; H. C. Todd, Maryville; and F. M. Browne, Kansas City, Kans.

The first number on the program for the opening session, Monday afternoon, April 3, was the annual address of the president, E. F. Carter, of Columbia, Mo., vice-president and general manager of the Missouri Telephone Co. Recalling to mind the sleetstorm which visited the state of Missouri early last year, entailing damage which in the aggregate amounted to thousands of dollars, Mr. Carter said,

"Our hats go off to that vast body of workers who stuck on the job under most hazardous working conditions until service and plant conditions were restored to normal."

The speaker pointed out that the way in which to eliminate a large portion of the expense involved in repairing damage caused by sleetstorms is by making greater use of buried cable. This, he said, seems to be the most practical method of construction, particularly with respect to toll connections between towns.

Excerpts from his address follow:

"Present cable costs make such construction [buried cable] impractical except where relatively large cables are required. We believe, however, that costs will eventually be reduced to a point where it will prove to be less expensive to use cable than to continue with our present aerial construction of poles and wire.

A lot of telephone people have felt the same way about underground construction for a long time but progress has been slow. The subject is a live one and will eventually be worked out successfully as and when a type of cable is perfected that can be proven in economically as compared with aerial construction.

We believe further that with the highway beautification and widening projects planned by most highway departments, telephone companies will eventually be forced to abandon aerial construction. Greater difficulty is being encountered constantly in keeping the lines free from tree interference, and pole moves necessitated by road changes are frequently so expensive that either private rights-of-way or buried cable seem to be the best solution to the problem. . . .

General business conditions have shown improvement during the year. The agricultural situation likewise showed improvement over the state as a whole. With the exception of wheat production, which was slightly below the average in yield, the quality was better than the 1937 crop. Yields in other farm products were above average and prices maintained at favorable levels.

As a result of the upward trend and improvement in general business conditions, the telephone business likewise showed improvement. Most companies showed an appreciable gain in stations for the year and a corresponding increase in toll usage. This, of necessity, improved the revenues of most companies.

However, most, if not all the gain, was absorbed in increases in expense, taxes, wage increases and extraordinary repairs occasioned by sleet and other storm damage being responsible for consuming most, if not all, the gain. What was not eaten up in this manner was used to cover moves and changes in pole line locations, due to road and highway changes of farm-to-market roads, major highways and the construction of rural electrification power lines. . . .

The making of such expenditures wholly at the expense of telephone companies seems not to be justified under present rates; and rate increases even of minor denominations are likely to lead to customer losses and lost revenue. However, compa-

A. M. BENEDICT, president-elect of the Missouri Telephone Association, is manager of the Richards Telephone Co.

nies that fail to metallicize their lines will be unable to render a satisfactory grade of service, and failure to do so will ultimately result in lost patronage. On the other hand, where lines are made metallic, they require a heavier investment in plant, heavier maintenance expense, increased taxes, etc., which of necessity require increased income to cover.

Facts regarding the effect of the application of the Fair Labor Standards Act of 1938, which went into effect October 24, 1938, have appeared regularly in each issue in TELEPHONY. The committee of the United States Independent Telephone Association has done a remarkably good job in paving the way for an amendment to the present law to exempt small telephone exchanges.

Proposed Missouri Fair Labor Standards Act

"Our own legislature has under consideration a companion bill to the national fair labor standards act and while it embodies the same provisions as the national law, the bill does not apply to any business employing seven or less employes. As we understand this proposed legislation, regardless of a company being

R. W. HEDRICK, of Jefferson City, was re-elected secretary-treasurer of the Missouri Telephone Association by the executive committee.

made up of a group of small exchanges, the aggregate number of employes being in excess of seven, the law exempts each exchange which individually employes seven or less employes.

Statistics compiled with respect to the application of the national fair labor standards act indicate that the small exchanges of 1,000 or less stations would, under the maximum provisions of the act, be required to increase rates to meet increased wages from one to two and one-half times present charges. Such rate increases, even if granted by state commissions, would be impossible to place into effect without wholesale reductions in the number of stations to be served.

Revenues would, therefore, not be increased in proportion to the requirement of increased expense. Such a condition would necessitate further revamping of the company's operations with the possibility of lessening the number of hours exchanges could remain open. This, of necessity, would increase the amount of unemployment and undoubtedly result in unfavorable public reaction regarding its inability to receive service at all hours.

While some companies might be able to convert to the automatic equipment with a minor increase in rates, it is doubtful if many of them could, as they have reached about the maximum of possible revenues under their present form of operation. Any change in type of equipment for exchanges on the verge of bankruptcy at the present time, under present conditions, would surely result in the abandonment of service for such communities entirely.

It would, therefore, seem that our representatives to Congress and our state legislature would view favorably the enactment of amendments to present laws or the enactment of new laws to clarify apparent errors in the Fair Labor Standards Act of 1938, where concerted effort has been and is being made to acquaint our representatives with the disastrous effect of present legislation if it is to be enforced as is. . . .

While we believe the matter will be cleared up shortly in a satisfactory manner, there is nothing definite in the way of assurance to give you at this time. We, therefore, suggest that the fight for relief be continued with no abatement until the battle is won.

Reports indicate that the year 1938 was one of progress for most telephone companies. Some companies were unable to hold their own the first six or eight months of the year, but the last four months decisive gains were made in stations with a satisfactory showing for the year as a whole.

Station revenues have shown general improvement for the year with long distance revenues just about on a parity with 1937. The increase in gross operating revenues, however, was in most cases more than absorbed by increased taxes and continued increased wages. Net operating revenues were slightly less in 1938 than for 1937.

E. F. CARTER, Columbia, retiring president of the Missouri association, said in his annual address, we should view taxes in the light of values and benefits.

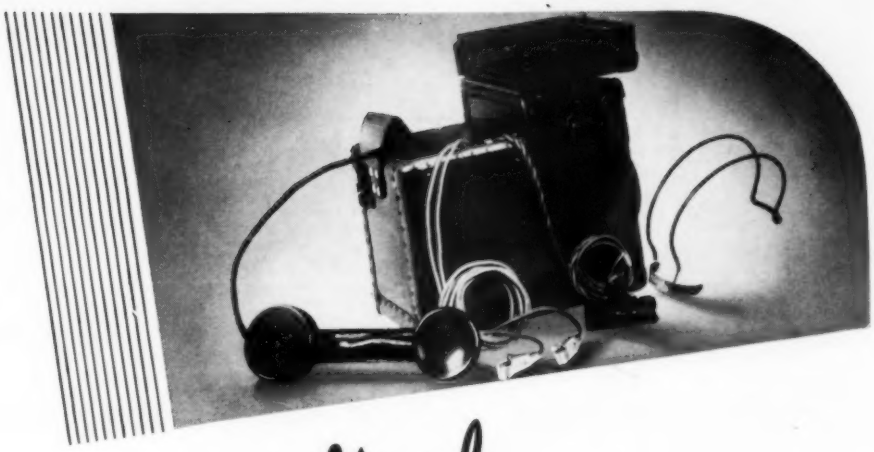
Taxation Considered the Light of Progress

"Taxes continued to rise in 1938 until the average per telephone throughout the country amounts to approximately 80 cents per month. Everybody, except possibly some of our politicians, feels that taxes are too high. We go around 'Robin Hood's Barn' to talk about and deplore the enormous burden of taxes we are required to pay. Even though we do a lot of griping about it, still we go on paying the taxes and do little if anything to obtain relief.

When comparing the amount of taxes paid today with those of 10, 20 or 30 years ago, they do look terrible if we stop there. But how many people in making these comparisons take into consideration the changed conditions in the amount and variety of public services obtainable 10, 20 or 30 years ago, with those of today.

We are living in an age of progress and if we want to enjoy the advantages gained throughout the years, we must expect to pay the fiddler. Please do not misunderstand me or interpret my remarks as approving all the things being done that are responsible for increased taxation, for I do not.

(Please turn to page 47)



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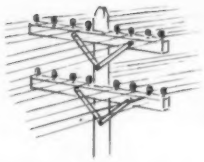
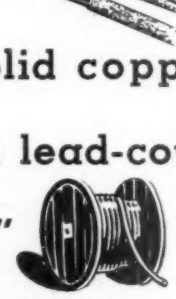


When spring is in the air, outside plant men begin to think of new construction. Poles and crossarms which have failed to withstand the ravages of winter must be replaced. Broken insulators also should be replaced, with "Whitall Tatum" or "Hemingray" products. If new wire is required, we suggest "Perfected" strand , since repair costs or interruptions in heavy-traffic circuits more than offset the price differential between good wire and poor. If drop wire is installed, make it "Copperweld" whose core of steel welded to an outer jacket of solid copper, combines strength with high conductivity. When lead-covered cable is needed, specify "Standard Underground"  for long life and trouble-free service. To be sure of getting only quality products such as these, order <u>all</u> of your supplies from AUTO-

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NEW IDEAS AND SHORTCUTS

By RAY BLAIN

Pedestal Type Cable Terminal

Proper use is seldom made of the pedestal cable terminal in general telephone construction. By this we mean that often a more expensive method is used when the pedestal would have done the job even better.

When underground distribution is used and the installation of an underground type terminal in a pull box is not considered desirable, the main terminal may be installed on a pedestal and the lateral cables run from it. This method of construction has been tried in many localities and proves entirely satisfactory.

Again, on long important underground cables the need of a test point in order to sectionalize the cable in event of trouble is often considered necessary. On such jobs the test point may be an ordinary FX box mounted on a concrete pillar in the manner indicated in the illustration. The entrance conduits are embedded in the concrete and the whole makes a very neat installation.

Some may say that all such cable terminals, including those for local distribution, may well be mounted on an ordinary wood pole. This is quite true, but we believe that the pedestal method is just as good or better; is as cheap and certainly more convenient. More of this type construction will probably be seen in the future.

▼ ▼

Use of Extension Crossarms

The advantage of using the extension crossarm, formerly known as the alley arm, is not often considered in telephone work. These extension arms are generally standard crossarms. Instead of being installed with a through bolt in the exact center of the arm between the two pole pins, the attachment to the pole is made at one end between the two end pins. A long and rather heavy brace then extends from the pole to a point near the outer end of the arm. This provides nearly the same strength as when the crossarm is mounted in the usual manner.

These extension crossarms can often be used to clear trees to avoid the expense of moving the line when trimming is impossible. Sometimes they can be used to clear power lines or new buildings when the moving of the line would prove expensive.

Some construction men claim that they avoid the use of the extension arm due to the difficulty linemen have in working on them. The newer type brace has a step in the center for the lineman to stand on while working, and thus he is able to reach out to the end of the arm with practically the same ease as when it is mounted in the usual manner.

Some also object to the extension arm as they claim its use weakens the line. This may be true to some extent; however, if only a few are used the weakening effect will be so slight that it undoubtedly will never be noticed. Push braces and guys may be used at these points in the line, so that the extension arm poles will be just as strong as any pole in the lead.

When better clearance is needed at a certain point in the line the use of the extension arm may well be investigated.

Extension type crossarms can often be used to provide better clearance for line wires without moving poles.

▼ ▼

Use of Telephone Signs

Recently a restaurant was visited which displayed in small, neat letters on its plate glass doors, this sign: "Through these doors pass the grandest people in the world, our customers." It was observed that everyone paused and read the sign; so why would it not be quite appropriate for the doors of a commercial office?

Recently, having occasion to locate a telephone office in a fairly large town, we drove right past it, even though we had the street address; we were looking for a sign and none was displayed. Telephone companies in general do not make proper use of signs in and around their exchanges. We think that the Independent industry should redesign

When a test point is needed on an important cable an ordinary FX box may be mounted on a concrete pillar in the manner shown in the photograph reproduced below.

WHAT is your "pet kink" or best method of doing a certain job? Why not tell others through this new department?

for Plant and Exchange

its office signs and then sell them to everyone and insist that they be displayed above their offices. Signs should also be placed on the outside of buildings to indicate that a pay station is available for use on the inside.

Some companies erect large billboard signs on all roads leading into their territory, urging people to make use of their long distance facilities and mentioning some important facts concerning their community.

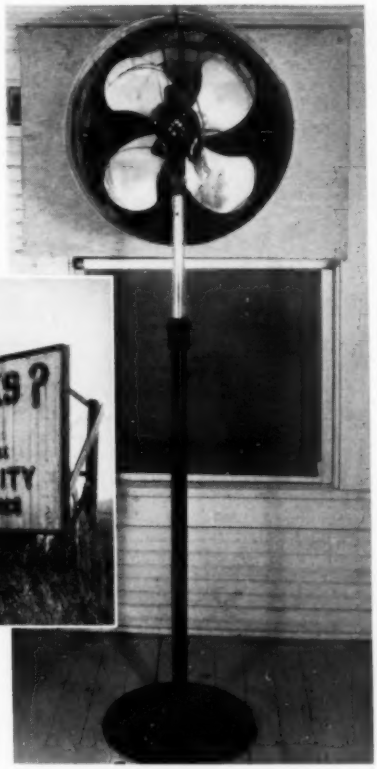
And line and construction trucks should be properly identified with signs to indicate their purpose and with the name of the company and the name of the town that the trucks work from. It is always a lost opportunity to see a nice construction truck without a letter of any kind on it to indicate its purpose in the world.

Some companies erect large billboards along the main roads leading into their territories, urging people to make use of their long distance facilities and mentioning some interesting facts about the community. This is a very good practice and one that should be followed more generally.

▼ ▼

Ventilating Fans in Exchanges

Good fans now fill a most important need in our telephone exchanges. The old type fans made so much noise and moved so little air that their use in the telephone exchange, especially the operating room, was extremely limited. This defect has been taken care of in fans of new design, and they are now used near busy switchboards without causing the slightest annoyance to the operators.



→ Ventilating fan should be placed near a window to blow outward. Note the protecting shield.

Fans are frequently used for ventilating purposes to remove the heat load from rooms or attics so as to maintain a lower temperature inside of rooms. Often the temperature in a room may be lowered as much as ten degrees by the proper use of good ventilating fans.

Fans are now often used for so-called night cooling of buildings. This consists primarily of drawing a large volume of cool night air through the rooms to cool the building interior and walls so that the outside heat will not easily or quickly be conducted to the interior of the building the next day. This arrangement has proved of real value in all installations which have come to our attention.

When a fan is used to ventilate a building it is generally placed near a window to blow outward, drawing the air through the building. Best results are ordinarily obtained by placing a metal shield, at least two feet in length, around the fans in the manner indicated in the accompanying illustration. Telephone companies should investigate the possibilities of good electric fans in their exchanges before the real hot weather comes.

▼ ▼

America's First Commercial Coaxial Cable

The first installation in the United States of coaxial cable for commercial purposes is scheduled for completion in 1940 and for partial operation in 1941. Authorization for its construction between Stevens Point, Wis., and Minneapolis, Minn., by the American Telephone & Telegraph Co., Wisconsin Telephone Co., Northwestern Bell Telephone Co., and Tri-State Telephone & Telegraph Co. was recently approved by the Federal Communications Commission. The cost of the project, covering a distance of about 195 miles, is estimated at close to $2,000,000.

Telephone traffic over the route through Stevens Point to Minneapolis has been increasing steadily and facilities are being used practically to capacity.

As this is a route connecting the East, including Chicago, with an important area containing a population of nearly a million, it is desirable to provide facilities adequate to take care of growth for some years in the future. Added reliability will be given to the service by substituting cable for aerial wire, as this area is frequently swept by sleet and snowstorms.

The cable will be partly aerial and partly underground; there will be 101 miles of aerial construction, 73 miles "buried" and 21 miles of underground conduit construction. Four coaxial units, which can ultimately provide 480 telephone channels, will provide two complete paths of transmission in each direction.

In case of trouble on one path, the

(Concluded on page 46)

The Symphony in Sand

By LEWIS T. NORDYKE

THE WIND changed to the northwest and whipped across the plains. The horizon turned to a dirty, yellowish color and appeared to move with the gale. Within a short time tons of earth swirled in the wind. Farmers, ranchers and business men in Colorado, New Mexico, Kansas, Oklahoma and Texas grumbled. Women wept as dust sifted through tight windows and doors and settled on furniture and rugs.

On the highways and streets, traffic moved at a crawl. On country roads, cars and trucks stalled like balky horses. The usual human complaints, which commonly reach the oath proportion, were heard whereever there were voices and ears in the range of the plains' dust storm.

Perhaps only four persons in the world were happy about the dust storm. They were happy because they depended upon dust storms for success in their immediate work. The four—three men and a woman—had been assigned to work toward a solution of the biggest regional problem in the telephone industry in America: that of dust on telephone lines.

So while plains' residents went about their work and grumbled about the dust storm, M. T. Dow, W. E. Reid, J. L. Lindner and Miss E. Rentrop of the Bell Telephone Laboratories in New York City worked frantically to tune in their machines on the symphony in sand.

The dust and sand storms with their resultant static electricity have caused all telephone companies operating in the southern great plains region their chief weather worries. Storms blow down poles, break lines and cause damage and expense in general, but these things can be fixed. But the dust problem still is without a solution.

During the past early spring, and last summer, the laboratory experts worked in the West, testing dust noises on lines between Amarillo, Texas, and Trinidad, Colo.; between Oklahoma City and Amarillo, and between Oklahoma City and Albuquerque, N. M. In this region of wide-open spaces stretch the longest circuits of bare wires in America; and it is this type of line that is greatly affected by dust.

The swirling dust generates electric charges, or static. When the dust contacts the telephone lines, they absorb the charges. These charges build up voltage on the wires which is the foundation cause of the noises.

Although the laboratory experts have not announced a solution, they have determined several interesting facts about the symphony in sand.

(1.) Dust causes two kinds of noises on telephones—a hissing and a popping crackle.

(2.) All dust storms do not cause the noises. Different storms, which look alike and apparently affect everything else alike, do not cause the same sounds.

(3.) Some snow generates static that affects telephone lines.

The noise problem is more serious than the average telephone user or telephone company employe may think. During last spring's dusters telephone companies in affected areas lost many long distance circuits because of the noises. Even the laboratory workers were surprised at the bigness and seriousness of the problem.

The average person (and perhaps some of the employes of telephone exchanges) who dials a number or transacts business by a long distance call, likely doesn't know it but he is protected by little carbon protector blocks, many of them. The carbon block serves the same purpose as a safety valve in a boiler.

When a charge is built up in a telephone line—by dust, lightning or any other disturbance — there must be a breakdown. It can't be in the telephone exchange; equipment might be harmed. It can't be in the home or office of a telephone subscriber, for the protection of subscribers is the first consideration of any telephone company.

So the breakdown occurs in the carbon block. When dust builds up the voltage to the breaking point, the break occurs in the protector block, the charge jumping through the block onto a ground wire. When the jump comes, the escaping charge causes the popping sound—the circuit destroyer — on the wires. If the dust storm is severe, it may have another charge built up by the time the preceding one hops the gap into the ground, thereby causing a constant popping noise.

It is this thing the laboratory people were laboring to stop. All information gathered was prepared for further study in the New York laboratories with the view of designing equipment to eliminate the noises.

With the information was perhaps the world's only true symphony in sand on a phonograph record. The popping tunes the static played on the telephone lines during a dust storm were recorded. Not very sweet music, indeed; but that record will be played over and over, and it will have an attentive audience of a man or two.

The laboratory workers used listening, recording and measuring equipment; machines designed for the special purpose of measuring noises on telephone wires. They were not interested in determining how dust generates electric charges; that is a known fact.

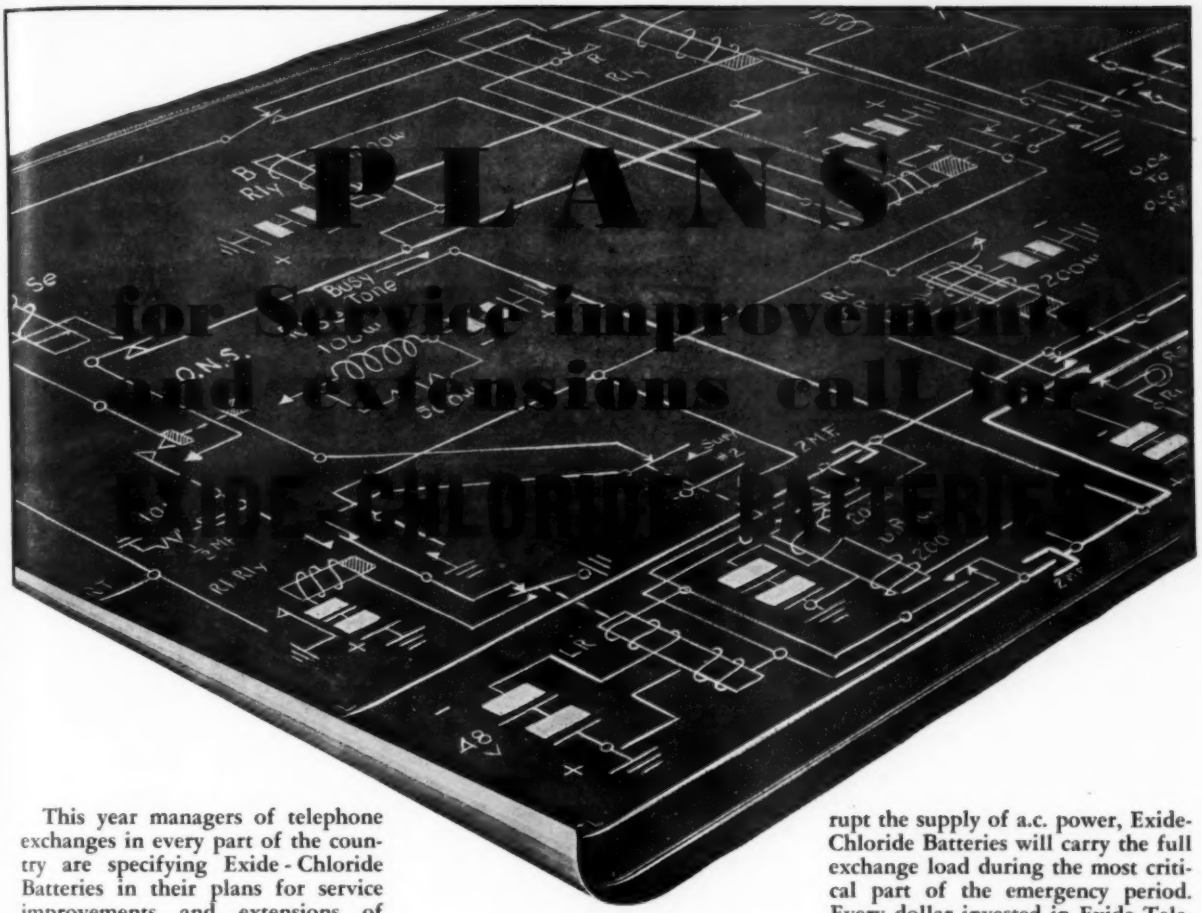
At the Texas Technological College, at Lubbock, engineers trapped charges generated by dust, and the electricity was made to pull a motor. During many of the severe dusters an automobile will not run unless it is grounded—that is, a chain or wire is tied to the machine and allowed to drag on the ground. The electric charges from the dust short-circuits the ignition system.

This spring agricultural experts decided that perhaps the electricity generated by the dust storms injures wheat and other crops more than does the dust. Some of the first crop insurance ever paid by the government under Secretary Henry Wallace's wheat insurance plan was paid farmers who had "electrocuted" wheat.

So the presence of the electricity is a known fact. But how to keep it from putting out of commission hundreds of miles of telephone wire is a problem yet to be solved.

The protector blocks can't be eliminated. Therefore, the big job is to figure out a way to eliminate the dust noise—drain it from the wires without interfering with voices, tele-

(Please turn to page 46)



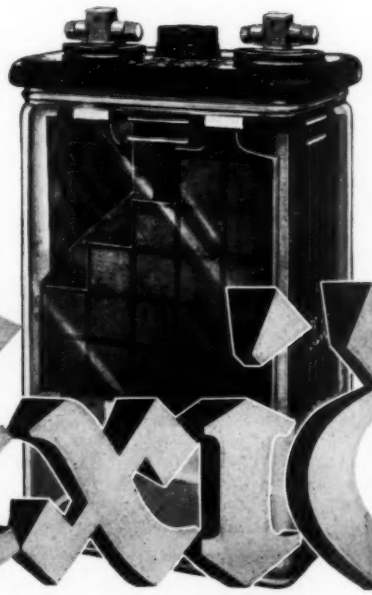
This year managers of telephone exchanges in every part of the country are specifying Exide-Chloride Batteries in their plans for service improvements and extensions of facilities in the communities served.

Day in and day out, for a long period of years Exide-Chloride Batteries will do their full share of the normal routine exchange operations. However, it is *when things go wrong* that you can call upon these "Foul Weather Friends" with full assurance that they will deliver their tremendous reserve of power when, and as, you need it to keep lines in service.

When unavoidable bad weather, street accidents, fires and floods disrupt the supply of a.c. power, Exide-Chloride Batteries will carry the full exchange load during the most critical part of the emergency period. Every dollar invested in Exide Telephone Batteries assures just that kind of absolutely reliable emergency operation.

No matter what your telephone battery job may be — common battery, emergency reserve, signalling, P.B.X. — you cannot select a better battery than an Exide-Chloride.

Whenever utmost dependability, long life and freedom from care are the determining factors, the Exide-Chloride type of telephone battery is generally used.



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Plant Men Talk Things Over

Vibratory Breakage of Line Conductors Demonstrated

The weight of ice itself is not entirely responsible for ruptures of sleet-laden wires in winter. Theory and experimentation proved "dancing wires" —the line forman's name for oscillation brought on by the peculiarities of a storm—the cause of excessive breakage.

A model representing a section of transmission line vibrating between four springs will demonstrate this phenomenon in the Westinghouse Electric & Manufacturing Co.'s exhibit at the New York World's Fair. Vibration will be sustained by the breeze from an ordinary disk fan hidden from view. To the ordinary bystander, the apparatus will appear to show perpetual motion.

A horizontal wind blowing on the wire has no component of force tending to lift or depress the wire, unless the wire is moving vertically and has a cross section of sleet on a wire which is not a true circle.

If it is moving vertically, the vertical component of force from the horizontal wind action on the non-circular section of wire is always in the same direction as the motion; if the wire is running upwards, the force tends to move it further upwards, and if the wire is moving downwards, the force tends to move it further downwards. This results in vibrations up and down at the natural vibration frequency.

Since all the energy supplied to keep such a vibration going is used in friction and windage losses, if the wind is very strong the amplitude of vibration of the wires becomes very great.

These conditions may be, and often are, simultaneously fulfilled in the type of sleet storm usually encountered in this hemisphere. These onslaughts are usually cyclonic, progress from west to east, with the local whirl wind in a circular counter-clockwise motion.

The duration of such a storm is divided into three periods. The first represents storm incidence, characterized by moderate winds in general from northeast, east or southeast, depending on whether the storm center is north or south of the locality, a considerable drop in temperature, and precipitation, sometimes in the form of sleet.

In the second stage the cyclonic wind of the storm proper blows all around the locality in question. There is little or no wind at the center. The temperature may rise, and the coating of ice on the transmission lines tends to melt. If the storm progresses from west to east fairly rapidly, the period does not last long enough for all the sleet to disappear, and the sleet coating assumes an elliptic shape.

A large drop in temperature and strong winds from southwest to west and northwest and finally to north, with clearing and a rising barometer, marks the final period. It is then that vibration and breakage take place.

▼ ▼

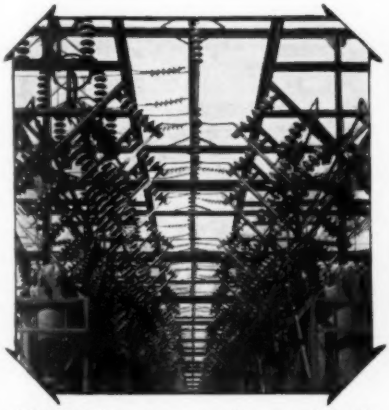
Unprecedented Cable Break Repaired by Untiring Splicers

Approximately 13,000 telephones in a suburb of Dallas, Tex., were recently rendered useless and residents of that area faced a serious emergency. Telephone communication between the sub-

Grimy and tense telephone linemen worked feverishly throughout the night in order to restore service over an important cable connecting one of the suburban exchanges of the Southwestern Bell Telephone Co. to the main exchange in Dallas, Texas. Most of the 8,800 connections were restored by daylight. The photographer who caught this unusual picture was suspended over the side of the viaduct by his assistants; he clicked the shutter of his camera while hanging in mid-air onto the end of a rope.

WHICH PICTURE ARE YOU IN?

RAILROAD? Then surely you know about Gould Batteries and their reputation for unfailing service in every kind of railroad application. Some 55 railroads in the United States depend on them for such duties as operating signals, interlocking, car retarding, lighting and air-conditioning.



UTILITY? You, too, are well aware of Gould. It's the battery used by more than 70 important utility companies to supply unfailing energy for the operation of circuit breakers, relays, indicators and emergency lighting.

INDUSTRIAL? You probably know that Gould Kathanodes keep countless industrial trucks gainfully employed . . . but do you know why in motive power service this famous battery outpulls batteries of ordinary construction?

TELEPHONE? Every telephone man knows that smooth, uninterrupted service depends on an unfailing source of steady, direct current. And most of you know that Gould Batteries meet these rigid requirements to the letter.

MINING? If you're a coal operator you're on the lookout for anything that will keep your locomotives on the job longer . . . give them plenty of reserve power for extra heavy duty. In hundreds of coal mines the answer to this problem is Gould Kathanode Batteries.

For Over 40 Years Gould Has Made Batteries for Every Industrial Application!

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GOULD

urban community of Oak Cliff and the city of Dallas proper were broken about 6 p.m. in the evening. It was found, by workmen engaged in tracing the trouble, that four main cables of the Southwestern Bell Telephone Co., containing 2,200 pairs of small wires had been destroyed by smouldering flames underneath a viaduct. The fire was believed to have been caused by a cigarette carelessly tossed aside by a motorist traveling across the viaduct.

Trouble crews working feverishly throughout the night had restored most of the connections by daylight of the following morning. This required the removal of a 20-foot section of the damaged cable. Twenty-two expert cablemen, perched precariously on a narrow cat-walk beneath the viaduct, had almost finished splicing the 4,400 individual wires at each end—a total of 8,800 separate connections—when the photograph reproduced on this page was taken.

Police and fire officials acted quickly to ease the situation by setting up emergency stations in the suburb.

The intra-exchange service was not affected, and the residents of the suburb were advised to notify the telephone operator in case of fire or trouble. Calls were then relayed to the headquarters established in the suburban fire stations instead of going directly to the central stations in the city proper.

Contact was established around midnight through one of the western suburbs and important emergency calls were relayed over that circuitous route.

Dallas telephone officials said the wholesale break in service was unprecedented in the history of Dallas, but it was an object lesson in the havoc that could result from a major catastrophe.

▼ ▼

Some Telephone Things I Didn't Know Until Now

BY RAY BLAIN

That the New England disaster of September 21, 1938, took 682 lives, destroyed more than 500 million dollars worth of property in eight states and silenced approximately 600,000 telephones for several days. This was the largest number of service interruptions in telephone history.

That cone-type earth anchors have been manufactured, and successfully used, which measured 34 inches in diameter and weighed 325 pounds each.

That a gaff gauge is now available for use in quickly checking the diameter of linemen's climber gaffs in order that they may be properly resharpened to conform to standard practice and to insure safety of linemen when climbing poles.

That an "automatic pipe anticipator" is available which gives an audible signal to a ditching-machine operator to warn him that he is nearing a pipe or cable. The tone, which changes to indicate the nearness of a foreign object, is heard from a loudspeaker or earphones.

That the Shanghai Telephone Co., Shanghai, China, takes special precautions to protect its equipment from the effects of sand storms in the Gobi Desert 800 miles away. All of the company's automatic control offices are protected not only against the effects of dust but also of moisture as well, by installation of air-conditioning equipment. This equipment not only cleanses the air but keeps it at the proper degree of humidity for satisfactory operation.

In The Nation's Capital

By FRANCIS X. WELCH

(Concluded from page 20)

Consequently, it may be possible that influence might be exerted to stem an economic trend having adverse social effects. Such a movement has been attempted already but so far without success.

Newspapers have a far greater capital investment and affect the employment of many thousands more people than radio.

Labor displacement resulting from technological development is one of the social problems of the modern age and, consequently, this is a significant economic factor to be considered in the future of radio advertising business."

Incidentally, the new member of the FCC, Commissioner Thompson, who has long been such an outstanding figure in the journalistic field, was confirmed by the Senate without opposition.

NEWS of the disturbing international situation abroad continues to make the Washington atmosphere very jittery. Out of the welter of alarming dispatches, occasional bits of information are tossed up of interest to the telephone industry.

Take, for instance, the tiny Balkan kingdom of Albania, recently overrun by the Fascist legions. The casual newspaper reader may be inclined to think of it as a comic opera type of principality, where the men folks dress in little white petticoats and wear the inevitable Mohammedan fez. From the telephone point of view, it is even more quaint—or was, until the Italians got there.

Tirana was probably the only capital city in the world where telephone subscribers had no numbers. They were indexed according to name; and if you wanted to call someone, you just told the central office operator the name of the party you were calling, and she looked it up in the index. However, as there were only about 300 telephone subscribers in the entire area, this was not such a difficult task as it may sound. It also gives one some idea of how primitive the erstwhile kingdom really was with respect to wire communications.

ANOTHER overseas dispatch tells us of definite plans being made by the British Post Office for furnishing radio programs by way of telephone wires as an emergency measure in time of war. Details were revealed a couple of weeks ago in the House of Commons, and the plan would seem to follow general defense lines which have been hinted in this department more than once. The telephone subscriber would be given a choice of four broadcast programs. The reception of ordinary telephone service over the same wire would not be interrupted.

The polite reason given in the House of Commons by the Post Office spokesman was the possible interruption of public radio reception (which will be very vital in the next war) by hostile bombardment of transmission facilities, or by artificial static, blanketing or other deliberate methods of interfering with wireless radio reception.

However, it is generally understood that an equally important, if not more important, consideration for undertaking such a reorganization of radio technique would be to insure closer control by the government of popular radio reception for propaganda reasons.

Such a program has long been considered in the dictatorship countries, and has even received some consideration in military circles on this side of the Atlantic. It would mean more business and responsibility for the telephone industry, even though most of us hope that such an emergency will never arise in this free land of ours.

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against service interruptions!

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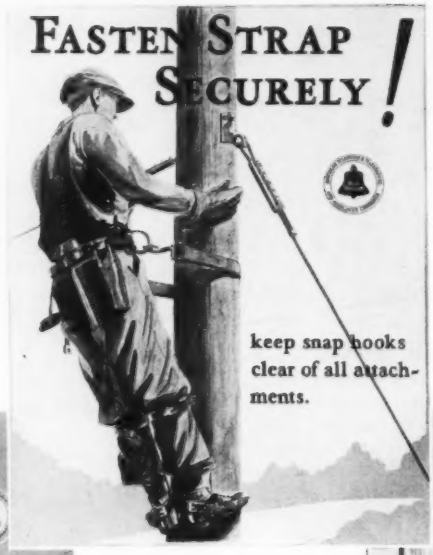
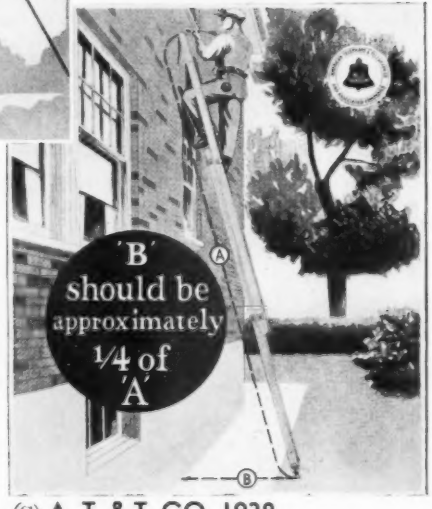
Safety Hints for Plant Men





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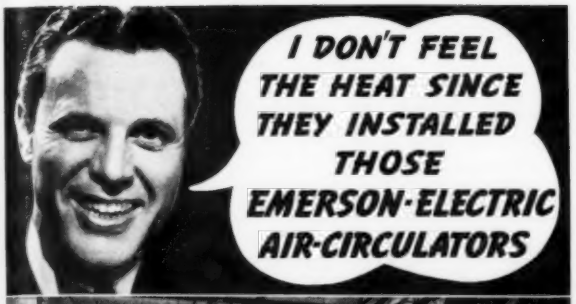

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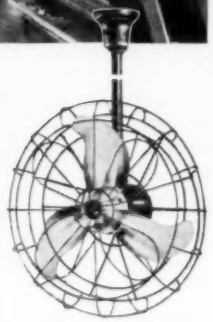
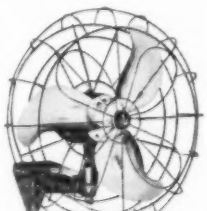


Emerson-Electric Air Circulator — Ceiling Mounting



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Overhead Structural Designs

By JOHN W. WOPAT

(Continued from page 24)

lead cable and steel messenger, the only rational method of suspension is one which will permit the cable to take care of its expansion and contraction in long, sinous waves, so that at no point will the stress in the lead go beyond its elastic limit. This can be done by using proper sags in supporting the messenger, even distribution of cable rings, lashing the cable or using clamps at the poles to prevent nodes or humps which are likely to occur at these points due to change of direction of cable due to sags.

To study the proper sags in messenger, the fundamentals of suspended wire must be investigated. A wire of uniform weight per foot when suspended between two supports will describe a catenary curve, as is well known mathematically. For catenaries of small deflection, such as in the ordinary span, the curve is practically that of a parabola; and the horizontal tension in the center of the span may be expressed in the following equation:

$$T = \frac{Wx^2}{2d} + \frac{d}{6}$$

T = Tension in pounds.
W = Weight of messenger and cable in pounds.
X = ½ span length in feet.
d = Sag at center of span.

From this equation the curve, messenger wire tension at center of span, was plotted, Fig. 2. Reference to the curve will show how rapidly the stress in the messenger increases for small decrease in the sag. For example, with a three-inch sag, the stress in the messenger supporting a 200-pair, 22 gauge cable would be 26,800 pounds; if the sag is increased to 18 inches the stress will be reduced to 4,470 pounds.

In addition to the great strain tight messengers place upon overhead structures, another peculiar effect occurs which has an important bearing on cable creeping. This peculiar phenomena is elongation of messenger under stress.

The following are the values of elongation of the three principal types of messenger commonly used; and the elongation values are with the elastic limits of the messenger and for each 500-pound load increment:

6-M messenger, elongation per foot 0039
10-M messenger, elongation per foot 00315
16-M messenger, elongation per foot 0027

A steel messenger is elastic and under a state of tension will elongate to an extent dependent upon the modulus of elasticity of the material. When the stress is removed the steel messenger will come back to its original length, provided the stretching has not been carried beyond the elastic limit.

A tight messenger will elongate

Heavy Loading

Span in Feet	Height of Pole: 16	18	20	22	25	30	35	40	45	50
	Length Out of Ground: 12.5	14.5	16	18	20	24.5	29	34	38.5	43
250	9.67	11.67	13.17	15.17	17.17	21.67	26.17	31.17	35.67	40.17
260	9.58	11.58	13.08	15.08	17.08	21.58	26.08	31.08	35.58	40.08
270	9.42	11.42	12.92	14.92	16.92	21.42	25.92	30.92	35.42	39.92
280	9.25	11.25	12.75	14.75	16.75	21.25	25.75	30.75	35.25	39.75
290	9.08	11.08	12.58	14.58	16.58	21.08	25.58	30.58	35.08	39.58
300	8.83	10.83	12.33	14.33	16.33	20.83	25.33	30.33	34.83	39.33
310	8.66	10.66	12.16	14.16	16.16	20.66	25.16	30.16	34.66	39.16
320	8.5	10.5	12.0	14.0	16.0	20.50	25.00	30.0	34.50	39.00
330	...	10.33	11.83	13.83	15.83	20.33	24.83	29.83	34.33	38.83
340	...	10.17	11.67	13.67	15.67	20.17	24.67	29.67	34.17	38.67
350	...	9.91	11.41	13.41	15.41	19.91	24.41	29.41	33.91	38.41

Note: Clearances given in table are assumed on level ground and conductors attached one foot from top of pole, and sags as given in table for heavy loading and at 100° F. stringing sag.

Clearance above ground at low point

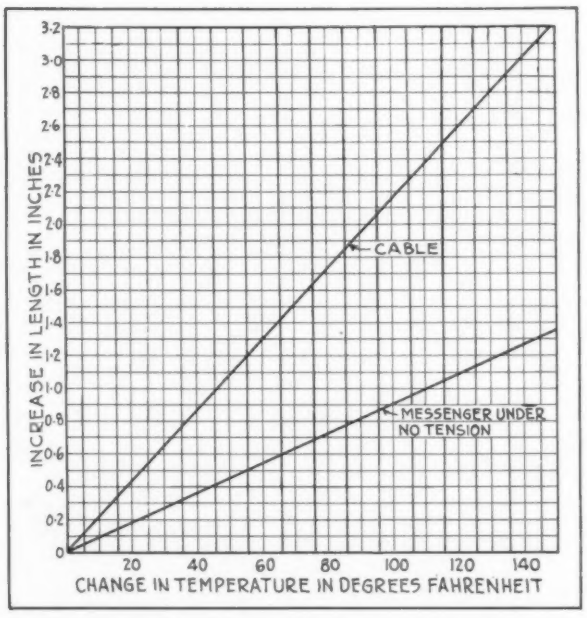

Fig. 1. Increase in lengths of cable and messenger with changes in temperature per degree Fahr.; length of span, 110 feet.

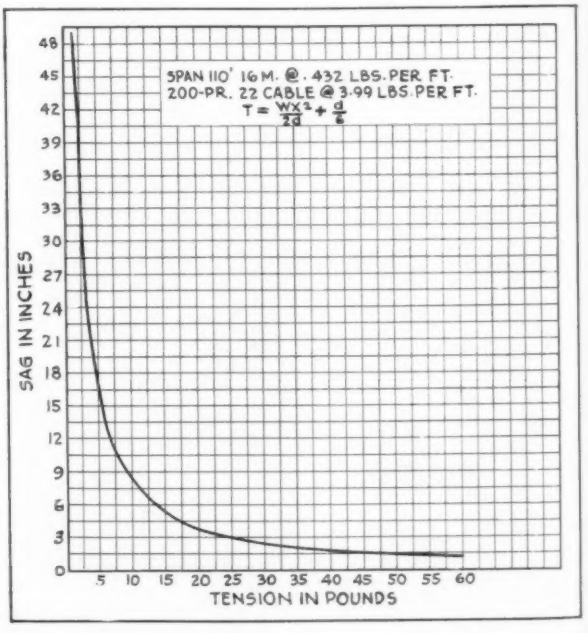

Fig. 2. Tension curve for cable messenger at center of span. Stress in messenger increases rapidly with small decrease in sag.

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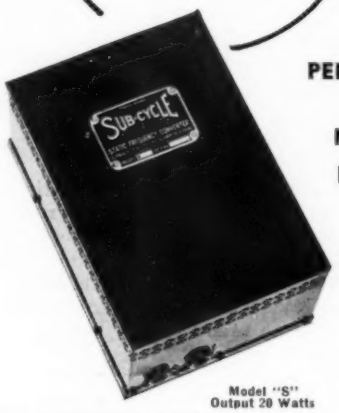

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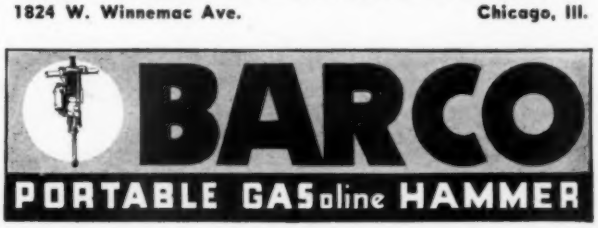

nearly an inch in a 110-foot span and its cross-section will also be proportionately reduced. Under these conditions, if the temperature should increase, the sag will, of course, tend to increase an amount dependent upon the temperature coefficient of the material; but the increasing of the sag or length also has a tendency to reduce the tension in the wire and thus reduce the elongation.

In order to show graphically the effect of sag and temperature on messenger elongation, Fig. 3 has been prepared. This shows the relation between increases in length of the messenger and various initial sags of 6 inches to 36 inches with temperature variations from 0 to 120 degrees Fahr. These curves are for a 200-pair, 22 gauge cable supported on a 16-M messenger and a 110-foot span.

It will be noted that for an initial sag of 6 inches for 100 degrees rise in temperature, the increase in length, the elongation, is 0.025 inch, which is practically negligible, whereas under the same conditions with an initial sag of 36 inches, the elongation is 0.75 inch, or 30 times as great. It is clear from these curves how little elongation is produced in the length of a tightly-pulled messenger, even with a wide temperature range.

Thus, it will be noted that in a tight messenger a condition of equilibrium will be reached in which it will be found that the length of the messenger will be increased but very little. Therefore, under such conditions, it is not a case of taking care of the difference in the expansion between the cable and the messenger, but instead almost the entire expansion of the cable will have to be taken care of and stowed in some place.

Obviously the movement which must now be concentrated in a bend or pole dip is very much greater than would have been the case if the cable had been placed on a messenger with a reasonable sag and, consequently, small tension.

It will now be apparent that if the messenger is pulled exceedingly tight, cable creeping and resulting crystallization of the sheath, due to constant bending, will occur. It is also apparent that a very slack messenger will not prevent some creeping because, even in a messenger under zero tension, the coefficient of expansion of cable is greater.

Slack, due to swinging, is as great an evil as a messenger pulled too tightly, and results in mechanical abrasion and ring-cutting as well as crystallization due to excessive vibration; therefore, the following suggestions are presented:

1. Cable should be installed on messenger pulled to proper sag.
2. Cable should be properly lashed or clamped at the poles, and cable rings evenly spaced.
3. Cable should be spliced in warm weather.
4. Avoid cutting out slack in warm weather, for this is apt to throw the whole weight of the cable on the core wire in cold weather, and either draws away from the corner or else tightens and stretches the core wire.

A word about cable terminals: Cable terminals should be sealed to withstand a pressure of approximately six pounds per square inch at 100 degrees Fahr. Cable terminals supplied by manufacturers usually meet this requirement. This is not true when terminals are rebuilt in operating companies' shops. If a company makes a practice of rebuilding old terminals, provisions should be made for testing the dielectric as well as pressure they will stand.

Wire Construction

Stringing tension is very important in open-wire construction. In the smaller companies the matter of tension is left to the strength of the lineman; in other words, he puts on his slack blocks and "pulls her up."

There are definite specifications for sags and spans for the various types and kinds of wires; these should be followed carefully. Lengths

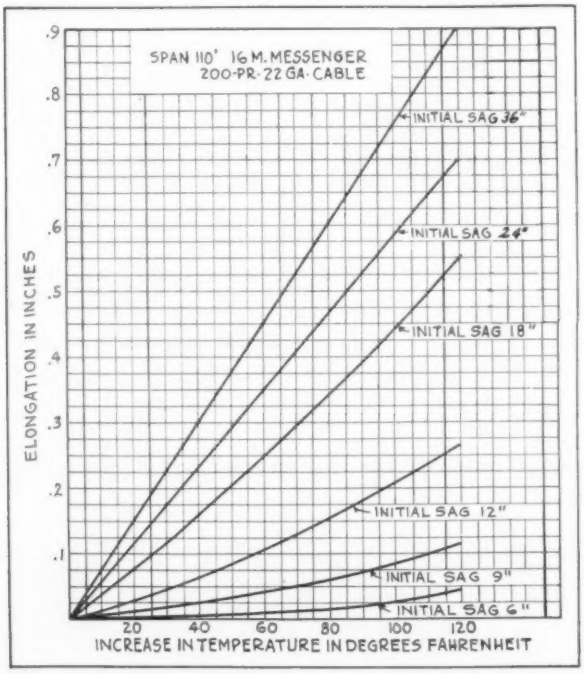

Fig. 3. Change in length of cable messenger for various temperature ranges, Fahrenheit.

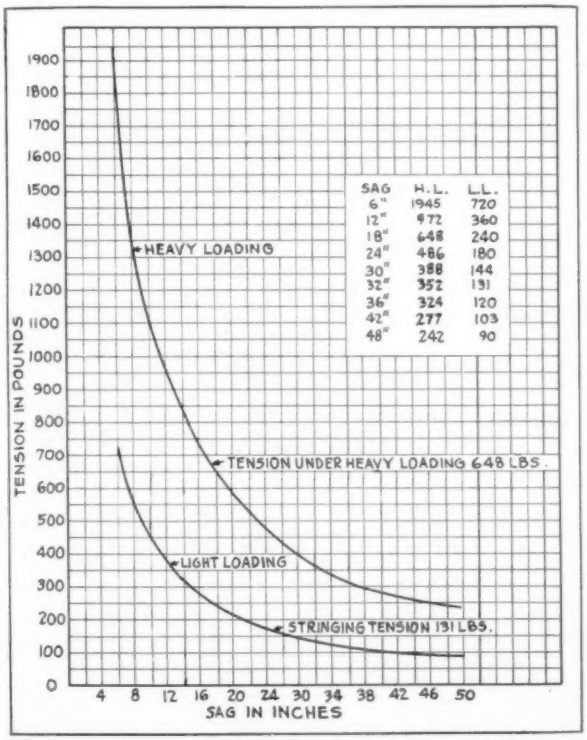

Fig. 4. Tension curve for .109 wire with 300-ft. spans for heavy and light loading.

of spans are definitely limited to the tensile strength of wire. For rural construction iron wire is usually used. For the present types of wire, which also have been used in the past, the following breaking stresses are given by the manufacturers: EBB, 425 pounds; BB, 476 pounds; steel, 512 pounds; these are for No. 12 BWG gauge wire.

Recently there has been placed on the market a high tensile-strength wire which has a breaking stress of 795 pounds for No. 12 BWG. This wire will permit of much longer spans. At first thought one may believe that with high tensile-strength wire, costs can be greatly reduced. They may be reduced but not to the extent one would expect.

Increasing the span lengths increases sags; this means higher poles. Cutting down the number of poles requires heavier poles to meet the transverse strength requirement. Working the wire at a higher longitudinal strength, requires heavier and better anchoring and much higher grade of wire fastening or dead-ending.

Long-span construction may introduce vibration moments, and this causes crystallization of the wire at the fastening. This difficulty is not new to power companies which have been using long span construction, but it will be a new experience to some telephone men.

In order to show graphically the longitudinal tension in a wire, Fig. 4 shows a No. 12 BWG wire in a 300-foot span. Two curves are shown: one designated as "heavy loading" conditions, and the other "light loading." From the heavy loading curve it will be noted that if the wire is pulled to a 6-inch sag, the tension will be 1,945 pounds which, of course, cannot be realized since the wire breaks at 795 pounds. If the same wire is pulled to a 32-inch sag, the tension will be 352 pounds.

There are marked on the curve two points, indicated by "x's." On the light loading curve at 32 inches sag, the stringing tension is 131 pounds; this same wire will, under heavy loading conditions, be subject to 648 pounds. It will be noted that this approaches the breaking tension, which is 795 pounds.

With the long-span construction the problem of dead-ending and supporting the wires becomes important. The ordinary brackets or crossarm pins are inadequate for dead-ending; so until a better scheme is evolved, it is recommended that the wire be dead-ended by means of strain in-

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sulators with proper cleaves or slings about the arm or pole.

The problem of splicing in long-span construction has to be carefully watched for the ordinary sleeve may fail before the wire breaks. Proper sleeves should be developed, and a special tie must be used. Extremely long-span construction for the present at least should be avoided as a general rule until, by experience, all possible faults are worked out.

Too much cannot be said about anchoring and guying a line; for a line is no stronger than its guys and anchors. A pole line is not merely a number of poles; it is a continuous structure. Satisfactory results can be obtained only when it is built and maintained as a continuous structure and its members replaced when weakened. A line can be built to withstand all storms but this is not economical. It should be built and maintained so that it does not fail with every storm.

▼ ▼

New Ideas for Plant and Exchange

(Concluded from page 33)

other path can be utilized, thus providing for greater continuity of service. While the cable can be made suitable for transmission of television, its use for that purpose is not presently contemplated. At the beginning, the coaxial units will be operated on a 2,000,000-cycle band, which is approximately half that required for television transmission. When fully equipped with terminal and repeater apparatus, the cable will do the work of two ordinary long distance telephone cables.

In addition to the coaxial units, it is planned to have four pairs of conductors for use in control circuits and to have 18 quads for 179 miles to handle short-haul toll service. There will also be several short-haul links of quads to connect various points along the route with the cable.

The actual manufacturing of the cable is to start soon. Already some 75 miles of pole line extending from the two terminals of the cable have been built—50 miles between Stevens Point and Neillsville and 26 miles between Minneapolis and Baldwin.

Before a decision was made to use coaxial cable on this section, which is a part of the northern transcontinental route, the A. T. & T. Co. made studies of other systems. It was found that coaxial cable would be the most economical by about $800,000.

The use of regular cable, with a large number of pairs, was considered as was also utilization of the type J carrier 12-channel system. Use of the latter system, in addition to its cost, was considered inadvisable because of sleet and storm conditions in that area; also, based on anticipated growth of traffic the installation of the cable would be deferred only a few years.

The estimated total construction cost for outside plant is $1,782,000, divided among the four companies. The cost of telephone repeaters and associated central office equipment is estimated at $152,000. New repeater stations will be installed at Neillsville and Baldwin, Wis., at an estimated cost of $35,000. Repeaters, which will be unattended or only require occasional inspection, will be placed at approximately every five miles when the coaxial equipment is completely installed.

▼ ▼

Symphony in Sand

By LEWIS NORDYKE

(Concluded from page 34)

graphic, teletype, radio and other services on the telephone lines. It may take a new system of equipment.

Aside from the various sorts of storms, the dust problem eclipses all other troubles from the weather. There are sleet regions in which service is greatly interrupted during the storms, and in some coastal regions there is considerable line trouble caused by the salty dampness from the sea; but for a regional problem that has the best telephone engineers scratching their heads and listening to a dust-created symphony on a phonograph record, the Great Plains' dust is the big boy.

The work of the laboratory technicians is part of the never-ceasing efforts of the telephone engineers to improve service. As a matter of fact, the engineer of today has as difficult problems as did Alexander Graham Bell when he started tinkering with the idea of improving the crude telegraph. He invented the telephone and obtained a patent just 63 years ago, but he likely never thought of the problems that would arise when strands of telephone wire stretched endlessly across the continent.

It is a safe bet that Dr. Bell, although he belatedly became the hero of a motion picture, never thought of how a plains' dust storm would affect a telephone line.

▼ ▼

Southern California Co.'s March Station Gain

A net gain of 3,087 telephones has been reported by the Southern California Telephone Co. for the month of March as compared with 1,918 for March, 1938. The net gain for the quarter was 10,294 stations as compared with 7,199 in 1938.

COMING TELEPHONE CONVENTIONS

Telegraph and Telephone Section of Association of American Railroads, Hotel Jefferson, St. Louis, Mo., April 18, 19 and 20.

Georgia Telephone Association, Piedmont Hotel, Atlanta, April 13 and 14.

Iowa Independent Telephone Association, Fort Des Moines Hotel, Des Moines, April 18-20.

Ohio Independent Telephone Association, Deshler-Wallick Hotel, Columbus, April 25 and 26.

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 10 and 11.

Conference of class A and B member companies, U. S. Independent Telephone Association, Chicago, Stevens Hotel, May 15 and 16.

North Dakota Telephone Association, Great Northern Hotel, Devils Lake, N. D., May 17 and 18.

Pennsylvania Independent Telephone Association, Yorktowne Hotel, York, May 18, 19 and 20.

New York State Telephone Association, Hotel Syracuse, Syracuse, May 23, 24, 25 and 26.

The Illinois Telephone Association, Pere-Marquette Hotel, Peoria, June 7 and 8.

Wisconsin State Telephone Association and Wisconsin Locally Owned Telephone Group, Park Hotel, Madison, June 13-15.

Washington Independent Telephone Association, Hotel Monte Cristo, Everett, June 23 and 24.

Oregon Independent Telephone Association, Portland Hotel, Portland, June 26.

Michigan Independent Telephone Association, Hotel Olds, Lansing, July 26 and 27.

Missourians Alert to Happenings

(Continued from page 28)

On the other hand, we are not living in the horse and buggy days with more time at our disposal than we need. We are living in an age of speed and everything seems to depend on it.

It hasn't been many years back that the distance one's voice could travel by telephone satisfactorily was limited to a few feet whereas today it is worldwide in scope—the radio, aeroplane, ocean liners and automobile have played an important part in further emphasizing the annihilation of time and distance. Newspapers print and picturize the news as it happens, immediately, regardless of in what part of the world the events occur.

No doubt, we could do without numerous services locally, nationally and internationally, and not feel the loss to any great extent; but when we get accustomed to the use of something we like, we object to its being taken away from us.

I am of the opinion, therefore, that we should review taxes from the angle of what is behind them, the values and benefits they make provision for. Then if they appear repressive or of no value we should do our utmost to secure legislation to repeal them.

I believe Boake Carter is credited with the statement that, 'Taxes may take the widow's home, drive the farmer off his land, close the factory, ruin the business man, overthrow governments, and destroy civilization.' We haven't quite reached that stage in this country, and are not likely to as long as we, a sane people, are permitted to govern ourselves.

However, there is a possibility of such changes being wrought in our social and economic life, as and when we surrender that inalienable right that is ours, under our constitution, to govern ourselves.

Court Ruling Against Sit-Down Strike of Great Significance

"A signal for better times is that of the action of the United States Supreme Court declaring the sit-down strike illegal. In actuality, the high court's decision merely put the stamp of legal authority upon an already accomplished fact, for sit-down strikes had been outlawed by public opinion for some time.

This does not mean, however, that the high court's decision is of no great importance. Its psychological effect upon the business and economic situation should be immediate and far-reaching. In a democratic country such as ours, public opinion ultimately determines governmental policies and the nature of our laws, but public opinion alone could not in this instance provide sufficient assurance to persuade industry to launch programs of expansion, to put men to work and start the country along the road to economic recovery.

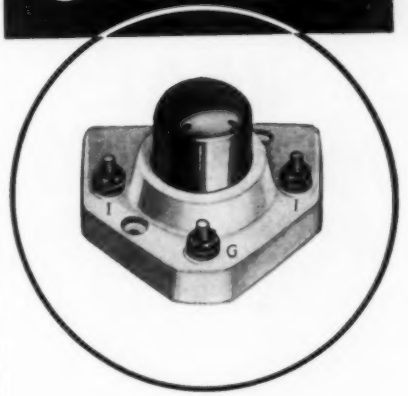
Assured by the Supreme Court's final word, industry can now proceed with far less hesitancy toward the reinvestment of private capital, which everyone agrees is the keynote to the country's future prosperity.

Public opinion was, and still is, on the side of labor in its crusade against unfair tactics of ruthless and arbitrary employers; and probably the sit-down strike was the inevitable outgrowth of a long period during which a few large and short-sighted industrialists refused to grant to workers their constitutional rights. But the sit-down strike with its obvious threat to law and order was condemned from the beginning by all except the most radical elements. Seasoned labor leaders in the A. F. of L. were quick to voice their disapproval.

Senator Wagner, author of the labor relations act, in commenting upon the Supreme Court's decision, said, 'I have always taken that view.' Frank Murphy, former governor of Michigan, so widely criticized for his official part in the Detroit situation, has since disclosed in his testimony before a senate committee that he did not condone the sit-down and cited the part he played in secret negotiations between John L. Lewis and representatives of General Motors to prove this point.

So, the Supreme Court's decision should clear the industrial atmosphere and stimulate progress toward better times to come. With the old-style autocratic type of employer rapidly disappearing and labor's rights firmly established on a democratic basis, the time is ripe for general cooperation on the part of all elements in the business community to employ the unlimited resources which we as the lucky citizens of the

SANDS



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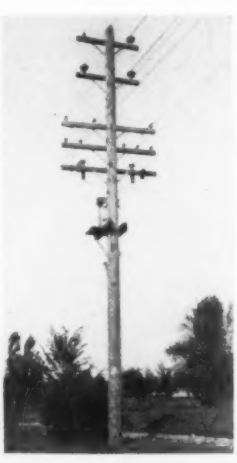

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richest country in the world, have at our disposal."

Following the presentation of President Carter's splendid resume of the telephone situation in Missouri and the encouraging situation confronting business in general, the next speaker of the morning was introduced, namely, R. B. Still, of Bloomington, Ill., president of the Illinois Telephone Association. In an informal manner Mr. Still made a very helpful talk on "General Telephone Topics," which was listened to with keen interest and appreciation.

"Young Men in the Telephone Industry" was the subject of the next program feature, presented by J. R. Carter, secretary of the Home Telephone Co., of Perry. Mr. Carter directed attention to the need for encouraging new blood in the Independent telephone industry.

He said he had been aware for some time of the scarcity of young men in the Independent field. The reasons, he pointed out, are three in number: (1) The positions available are quite limited; 2) the purchase of an exchange of any size requires capital which a young man does not have; (3) few young men realize the opportunities offered; (4) the hard and sometimes disagreeable work tends to discourage young men from entering the field.

Directing attention to some of the young men who have attained positions of responsibility in the Independent telephone industry in Missouri, Mr. Carter mentioned the following:

Foster McHenry, Jefferson City; George Hearne, Warrensburg; G. Thompson; Richard Sullins, Madison; John Leader, Ozark Central Telephone Co.; Claude Downard, Potosi; Bob Coxwell, DeSoto; W. Scott, Vandalia; Mac Wilhelm, Bosworth; Joe Roberts, Gallatin; C. E. Cooper, Mokane; Ralph Chapman, Green City; and Ted Marrs, Grant City.

Mr. Carter's paper, which sets forth the need for encouraging employes to "dig in" and become permanent members of the Independent telephone field, will be published in a future issue of TELEPHONY.

"Accounting Systems Prescribed by the Federal Communications Commission" was the subject of an interesting and instructive talk by Ranford Dunlap, general auditor of the Gary Group, Ft. Wayne, Ind. This was followed by a discussion of the "Telephone Situation in the Nation" by Louis Pitcher, Chicago, executive vice-president of the United States Independent Telephone Association. Mr. Pitcher gave a splendid talk along the lines of the problems confronting the industry today, especially dealing with the wage-hour situation.

President Carter then called on R. W. Hedrick, secretary-treasurer of the Missouri Telephone Association. After presenting his report as secretary, he questioned Mr. Pitcher on the wage-hour matter, bringing out some points of especial interest to Missouri telephone people.

Convention committees were then called upon by the president as follows: Nominating—L. H. Garst, Marshfield, chairman; Mrs. Wilma Willis, Harrisonville; and P. H. Carter, Salisbury. Resolutions— Dr. S. T. Neill, Clinton, chairman; Foster McHenry, Jefferson City; and Carl L. Spaid, Clinton. The latter committee was appointed to take action on the wage-hour matter.

After expressing his appreciation to the manufacturers for their splendid exhibits and cooperation, President Carter adjourned the session.

There was an attendance of 357 men and women at the banquet Monday evening, April 3. After the serving of an excellent dinner, a lecture-demonstration was presented on "The Magic of Communication," under the supervision of Irvin Mattick, information supervisor of the Southwestern Bell Telephone Co. It showed the latest developments of the Bell Telephone Laboratories and was entertaining as well as educational.

Following this program feature a large crowd danced until midnight to music furnished by Earl Coleman's orchestra.

After calling the Tuesday morning session to order President Carter turned the meeting over to H. B. Whatley, Southwestern Bell Telephone Co., Kansas City, who then presented a traffic demonstration of "How Local and Toll Service Can Be Made More Attractive." The first part of the program consisted of a dozen skits demonstrating the various types of calls received. This was a most interesting and educational number, furnishing many good laughs, in addition.

The traffic school which followed was attended by far the largest crowd ever in attendance at a Missouri traffic meeting and the interest of all present was sustained during the entire program. One of the features was a talking picture, "Your Company's Voice," demonstrating the methods used by all telephone companies in rendering service to subscribers and showing how the

telephone voice makes or loses customers.

The plant and maintenance program and conference, under the direction of John J. Cline, district manager of the Fidelity Telephone Co., of Sullivan, was well attended and a most helpful program was presented. This also had the largest attendance at a plant conference in connection with a Missouri convention.

A general business session was held Tuesday afternoon. The report of the nominating committee was unanimously adopted, resulting in the selection of the slate of officers and members of the executive committee for the ensuing year, as named previously in this report. After other items of miscellaneous business one of the best conventions held by the Missouri association was declared adjourned.

Telephone a Safety Device for Folks Who Live Alone

Arthur Irwin, veteran police news reporter of New York City, now executive secretary to Police Commissioner Valentine, places the telephone first on the list of safety devices for persons who live alone.

Burglary and the tragedies resulting from housebreaking can be prevented in a great number of cases if people will exercise only ordinary care, according to Mr. Irwin.

A telephone at the bedside, a bolt-and-chain lock on the door, a stick or bar tilted catty-cornered over the top of the open window-sash, a light near at hand—all these are safety devices which may mean much in an emergency.

Commission and Court Activities

Oklahoma Considering Repeal of Its 1937 Wage-Hour Law

Bills have been placed on the calendars of both houses of the Oklahoma legislature calling for the repeal of the 1937 wage-hour law. The constitutionality of the 1937 law has been sustained in part by the Oklahoma Supreme Court. It has never been applied to Oklahoma telephone companies, as no schedule has yet been adopted applying to the telephone industry.

There is a strong movement in the legislature to repeal the 1937 act and to pass a resolution to create a legislative commission to study the subject of wage-hour legislation and report to the next legislature, two years hence.

If Oklahoma telephone companies were compelled finally to comply with the 1937 Oklahoma wage-hour law, many of them would be seriously burdened and would be obliged either to curtail service or to cease operation altogether.

Oklahoma Legislature Passes REA Bill

A little REA for Oklahoma was created by S. B. 141, by Harbison, which has passed both houses and is scheduled to be approved by Governor Leon C. Phillips.

An effort was made to attach an amendment to the bill providing that the Oklahoma Corporation Commission would have jurisdiction over electric cooperatives organized and operating under the federal and the Oklahoma REA acts. This amendment was added in the house but was stricken in the senate.

Oklahoma telephone companies, therefore, will be unable to appeal to the Oklahoma Corporation Commission for relief from inductive interference with telephone grounded lines by rural electric cooperatives. The commission, several months ago, held that it has no jurisdiction to regulate the construction and service of rural electric cooperatives.

The only hope of Oklahoma telephone companies seems to be the enactment of legislation now pending in Congress to require REA-financed lines to bear a just proportion of the cost of eliminating inductive interference on grounded telephone lines, when caused by paralleling or overbuilding by REA lines.

Proponents of Oklahoma S. B. 141, scheduled soon to become a law, claim it will provide the organization machinery for building many more cooperative rural electric lines in the state. There are now 15 cooperatives, serving about 9,000 farmers in Oklahoma.

Pennsylvania Physical Connection Case Before Commission

In late February the Pennsylvania Public Utilities Commission received briefs and heard oral arguments (TELEPHONY of March 4, page 32) in its investigation for the purpose of determining whether the Bell Telephone Co. of Pennsylvania violated section 408 of the state public utility law in refusing to connect its lines with a privately-owned switchboard of McCloskey & Co., Philadelphia.

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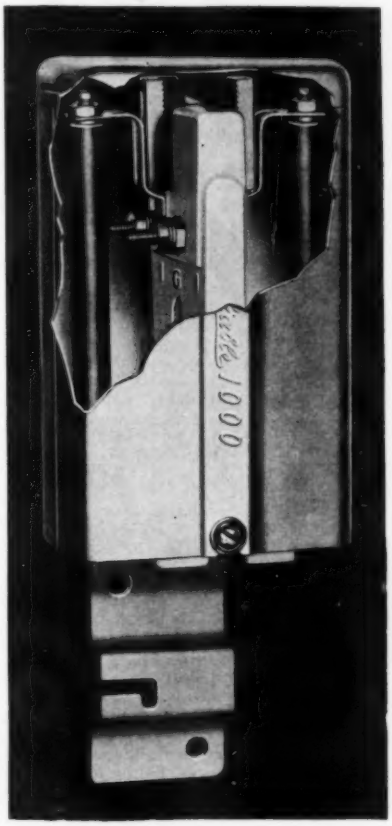

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In a brief filed February 20 with the commission, the Pennsylvania Independent Telephone Association, an intervening respondent in the case, says:

"The question is not which manufacturer's equipment is the best or whether a telephone exchange can operate satisfactorily buying part of its equipment from one manufacturer and part from another.

The question is whether the telephone company, which is responsible for the service, shall have the right to select all of the equipment with which the service is to be given.

It is absolutely necessary that the telephone company have this right in order:

(1) That each part of the equipment shall work in the most efficient manner with each other part.

(2) To permit proper and economical engineering so that the company will not be forced to install more expensive equipment to compensate for subscribers having installed inferior equipment or equipment with which it may be difficult to coordinate the telephone company's equipment.

(3) To permit orderly changes to be made in the plant—planned long ahead—so that subscribers will not have to change recently-purchased equipment because the telephone company is changing its equipment.

(4) Above all, to insure adequate maintenance of the equipment by trained, experienced men properly supervised."

▼ ▼

Indiana Supreme Court Upholds Commission Protection

The Northern Indiana Telephone Co., of North Manchester, was victor in a legal controversy in the Indiana Supreme Court on an appeal from an injunction granted by the Elkhart County Circuit Court upon a petition filed by the United Telephone Companies, Inc., of Warsaw. The Northern Indiana company has exchanges in several counties. The one at Claypool, having a manual switchboard, was connected by a long distance circuit to the exchange at Warsaw, the appellant owning about a mile of the line out of Claypool and the Northern Indiana company owning the remainder.

The Northern Indiana company installed an automatic switchboard at Claypool and notified the United Telephone Companies, Inc. that it could not maintain the manual service of the long distance line at Claypool. It stated, however, that there was available another connection between the two exchanges by which the Claypool exchange could be reached, or it could be done by the United installing an automatic service in the Warsaw office.

Upon notice of this action, the United sued to enjoin the Northern Indiana company from discontinuance of the manual service over the long distance line in question until final hearing on the question by the Indiana Public Service Commission. The injunction was granted in the Elkhart County Circuit Court.

In appealing from the injunction the Northern Indiana company contended that a court of equity has no jurisdiction in a matter of service. The state supreme court held that it was not necessary to decide this point, as the case was not a total discontinuance of service but only one requiring an adjustment of service, since the Claypool exchange could be reached through other exchanges.

The high state court held that the Indiana Public Service Commission has jurisdiction over the matter of dividing tolls on long distance business, so that the United will not be harmed materially by any delay in waiting a decision of the commission.

▼ ▼

Summary of Commission Rulings and Hearings

Federal Communications Commission

March 31: The Southwestern Bell Telephone Co. and the Mountain States Telephone & Telegraph Co. filed joint application requesting authority to supplement existing facilities between Friona, Texas, and Texico, N. M.

March 31: The Chesapeake & Potomac Telephone Co. of Baltimore City, Md., requested authority to supplement existing facilities between Westminster, Md., and the Maryland-Pennsylvania state line; and between Well's Corner and Harmony, Md.

April 3: The American Telephone & Telegraph Co. granted modification of point-to-point telephone license, to add Sydney, Australia, as a primary point of communication.

California Railroad Commission

April 10: Baird Telephone Co., which operated a line in Shasta county, having three patrons, authorized to cease operations in response to application asking to be relieved of its obligations. The company operated what was believed to have been the smallest public utility telephone system in the United States.

Michigan Public Utilities Commission

March 24: Approval given 50 exchange area maps filed by the Michigan Bell Telephone Co. as part of tariff MPUC No. 1.

March 31: Revision of Hemlock exchange map sheet filed by Union Telephone Co., approved.

March 31: Approval given revision

of the St. Charles exchange tariff map sheet filed by Michigan Bell Telephone Co.

April 7: Hearing in Lansing on application of the Stanwood Telephone Co. for approval of purchase and sale and for a certificate of convenience and necessity.

April 27: Rehearing in Lansing on the objections of the village of Saugatuck to the rates of the Tri-County Telephone Co. Postponed from March 29.

New York Public Service Commission

April 12: Hearing in Albany on commission's investigation of the intrastate toll rates of the New York Telephone Co. and other companies.

Ohio Public Utilities Commission

March 25: The Cincinnati & Suburban Bell Telephone Co. authorized to make reductions in independent residential rental in the Kirby and Central office localities. The rental of $5.75 a month was reduced to $4.75. Only 17 customers were affected by the reduction.

The company also was given permission to furnish two-party service at the rental now charged for four-party service.

April 5: The Farmers Telephone Co. of Quaker City authorized to file a new schedule which, in addition to republishing rates for magneto service, establishes the following rates for common battery service in Quaker City to be taken at option of the subscriber: business independent, $2.50; business four-party, $2.00, penalty, 25 cents; residence independent, $1.75; residence four-party, $1.50, penalty 25 cents.

April 5: The Ohio Standard Telephone Co. authorized to file, effective May 1, the following optional schedule for common battery service at Minerva: business independent, $4.00; business two-party, $3.50; penalty 25 cents; residence independent, $2.75; residence four-party, $2.25; penalty 25 cents.

April 6: Pleading that it has since July 31, 1934, expended from its treasury for the provision of net additions to its property in the state of Ohio not yet capitalized the sum of $4,900,000 and in the state of Kentucky the sum of $600,000, the Cincinnati & Suburban Bell Telephone Co. petitioned for authority to issue and sell at a price to be fixed by its directors, but for not less than par, $4,900,000 additional common stock, $50 par value per share.

Pennsylvania Public Utilities Commission

April 5: Hearing in Pittsburgh on the proposed changes in the "foreign exchange" rates of the Bell Telephone Co., of Pennsylvania. The changes were to have become effective February 1, but they were ordered suspended for six months by the commission.

South Carolina Public Service Commission

March 18: Order issued giving the Due West Telephone Exchange, Inc., authority to discontinue its free service between Abbeville and Due West. The company contended in its petition that the free line had become almost useless, since the construction of a parallel rural electric line.

Wisconsin Public Service Commission

April 6: The Marquette & Adams County Telephone Co., the Oxford & Hammond Telephone Co. authorized to continue present rates as emergency rates until January, 1940, when the rates will become permanent unless the companies ask for changes.

April 10: The Melville Settlement Telephone Co., serving about 70 subscribers in Chippewa county, granted authority to increase its rural rate to $2.00 gross, or $1.75 net, a month. The new rate will become effective when specified improvements in service are made by the company.

April 10: The Platteville, Rewey & Ellenboro Telephone Co. given permission to extend service to one applicant in the town of Belmont, Lafayette county, and denied application for extension to eight others in the same town. Six of the eight are now being served through the Rewey exchange of the Rewey & Mineral Point Telephone Co. The one extension granted was to a farmer who has no present service and lives only one-half mile from lines of the Platteville company.

April 18: Hearing in Shell Lake on the application of the Bashaw Valley Telephone Co. to discontinue free exchange service through Cumberland, to its subscribers on the Timberland Line.

April 19: Hearing in Hudson to investigate the request of the Hudson Prairie Telephone Co. for authority to increase its rates.

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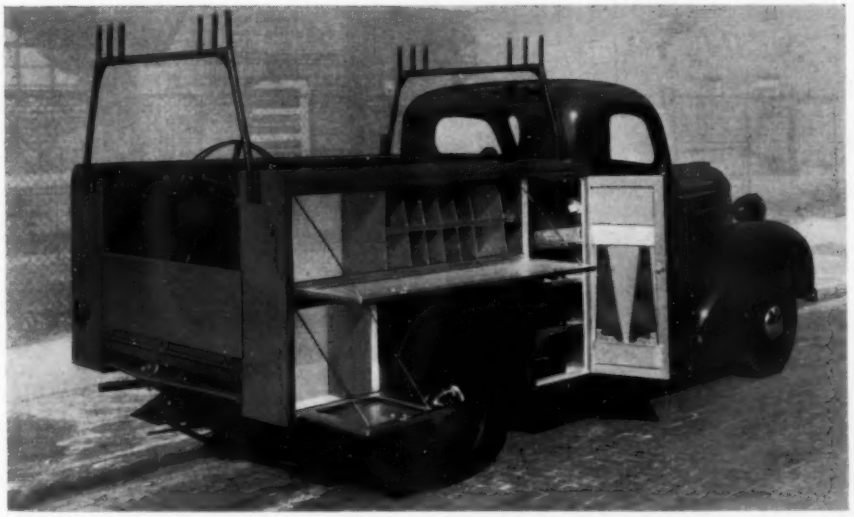

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Plant Construction Methods

By MILTON P. NAAB *(Continued from page 26)*

with care so that kinks or nicks will not develop. If iron wire is injured, it may mean that the outer covering of galvanizing is broken and then corrosion soon sets in. The result is that that piece of wire will not have as long life as it should have, and it may mean a service interruption if it breaks down. Copper wire is especially susceptible to injury and special precautions should be taken when placing it to prevent damage to the wire. A kink or a nick, if left, will usually mean "an open" when the first cold spell comes along.

Where it is necessary to splice open wire, the recently-developed single-tube sleeve makes a very good connection and can be made quicker than the twisted sleeve. A splice, properly made, using a single-tube sleeve makes a joint as strong as the wire itself.

You are familiar with the general types of copper and iron wire used for open-wire construction. Within the last several years a .109 high-strength steel wire has been developed. With this wire it is possible to use spans up to a maximum of 350 feet without increasing pole height or strength.

When building this type of line, poles of proper size and sound timber must be selected. The wire is placed with less sag than the regular iron wire; consequently, stresses and strains are increased, and the guying requirements are increased. In fact, with this type of construction, specifications must be followed closely so that all parts will be properly built to take care of the increased stresses and strains. The saving from the use of this wire is in the decreased number of poles needed for a given length of line.

Where aerial cable is used it is placed on suspension strand with metal hangers, the sizes of both depending on the size of cable. Generally such cables up to 404 pairs are placed in the air, although occasionally larger sizes are used. Particular attention should be given to the proper spacing and securing of hangers. All places where the cable might be injured by abrasions should be protected by cable moulding or other guards.

As the cable is pulled-in, it should be lubricated with oil or grease so it will slide smoothly through the hangers. Aerial cable may be pulled either with a regular winch rope or with a suitable manila rope which is wound up on a power take-up reel. For smaller cable a No. .109 fish wire can be used for pulling-in the cable, the wire being wound on a power take-up reel.

Where underground cable is to be installed in ducts, vitrified clay conduit, fibre duct, or creosoted wood duct may be used. Manhole construction may be either of brick or concrete. The latter will generally be better in the long run with longer life and less maintenance and can be poured in forms which are readily removable and available for re-use. Pulling-in irons should be placed in all manholes to facilitate pulling-in cable.

Underground cable when placed in ducts is pulled-in by means of a winch. The truck is spotted at one manhole, the winch rope threaded through the proper duct to the next manhole and there attached to the end of the cable, which has either been set up on jacks or is supported on a cable reel trailer.

A suitable feeding tube should be

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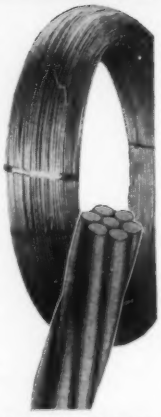

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used to feed the cable into the ducts and the pulling operation performed carefully so that the armor will not be kinked or damaged. Proper lubrication should be applied to prevent damage to the cable sheath by wear on the ducts and to make the cable pull easier. The splicing should be completed according to standard practices and the final joint made so that if the cable and splice are entirely submerged, there will be no failure.

In some instances jute-covered cable, either plain or armored, is buried directly in the ground. The cable can either be placed in hand-dug trenches or may be placed with a cable-laying plow, pulled by winch, truck, or tractor, if sufficient work is available to justify its use.

In general, the types of outside plant nave not changed much through the years, but the method of erecting and placing this plant has changed materially due to the increased use of power equipment, chief among which is the modern line truck with its associated winch, derrick, and power take-up reel. The introduction of power equipment permitted use of smaller and less costly truck units and smaller crews.

Where formerly crews consisted of eight or more men and a foreman equipped with a large two or three-ton truck, the modern crew consists of three to five men and a foreman equipped with a 1½-ton truck on which there is a winch, removable derrick, and power take-up reel. The small crew with the aid of this power equipment performs the same work which formerly required more manpower because there were formerly very limited mechanical aids to do the heavy jobs.

Our modern improved roads are also a big factor in the trend toward smaller, lighter and more mobile construction units. With the excellent travel conditions, greater distances can be traversed with little possibility of delays due to poor road conditions. The increased use of power equipment does not bring with it any more chance of injury to the individual, assuming that the proper training has been given.

This training, however, should not be confined to the use of power equipment alone but should cover all phases of the construction job. Along with this safety training, special emphasis should be laid on electrical hazards. All the construction people should be trained to be alert to any improper clearances between light and power wires and telephone plant and other improper conditions. The proper disposition of all such conditions should be promptly arranged if serious results to telephone plant and to human life are to be avoided.

Probably the greatest single influence in modern construction methods today is the matter of supervision. The foreman, because of the smaller size of crew, should be a working supervisor. He not only is confronted with the task of planning his work in advance but has the problem of training his men to do a good job. The best method of training so far developed is by job-training of the individual.

The foreman must know the specifications, and see to it that his men know them. He must demonstrate the proper methods of doing the work and watch his men until he is satisfied that they can follow proper practices. After the initial training period, sample inspections of the completed work will be a good indication whether the men remember and apply what they have been taught.

I have referred to training several times and have included in it safety practices, but I want to leave with you this impression; that regardless of how many times it has been discussed, it is still a very important factor in our construction work.

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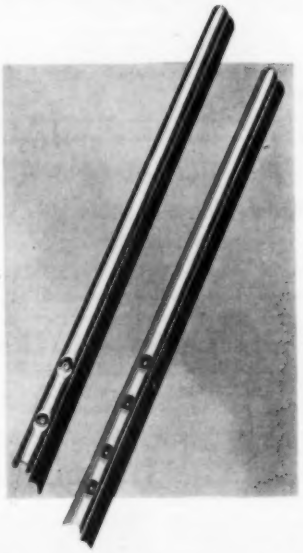

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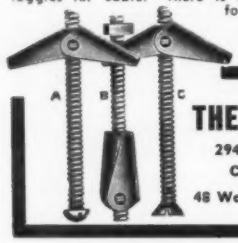

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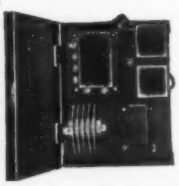

Good practices should always have safe practices for a basis.

If the foreman has a good knowledge of his work, if he understands his men, and if he knows how to do a good training job, he can, by being alert, instill in his men the proper attitude. After all it is not unreasonable to expect each workman to assume his share of the job responsibility, to follow standard practices, and to put in an honest day's work.

If, however, each workman does not assume his share of responsibility and there is a lack of coordinated teamwork between the foreman and his men, plant of inferior quality will result. Under such conditions not only will the plant be of inferior quality, but it may cause serious impairments by breaking down long before the end of its normal life.

Good construction methods and their relation to uninterrupted service can best be illustrated by the fact that if an instrument is installed properly, drop wire run in such a manner that it is not interfered with by trees and other objects; cable terminals are properly located, installed and wired; and underground cable is placed in the conduit undamaged and is properly spliced, the only opportunity that remains to cause interruption to the service is something beyond our control.

When all of us have reached the state of mind where we realize that each act we perform not only affects the immediate job at hand but has a definite effect upon the completion of the major problem (providing good telephone service), then we will realize that the setting of a pole improperly, placing of a guy incorrectly, the stringing of wire with too much or too little sag—yes, the very way you park your truck on the highway, the way you pass another vehicle on the highway and the way you visit with the general public in connection with your work—all have far-reaching results which in general will have an effect on your organization and the service it furnishes.

Try to instill in every construction man's mind the thought that labor costs are one of the big factors and that a job poorly done, or one not properly planned where lost time results, means waste of time and money. Try to do a construction job so that the maximum benefits can be secured from the material use. The idea of good, economical, and relatively uninterrupted service should be the ambition of every telephone employee. It is what the public is really buying, what it pays for and has every right to expect.

Illinois Bell Station Gain for March Encouraging

The Illinois Bell Telephone Co. reports a net gain of 2,494 telephones for the month of March; this compares with a gain of 229 stations for the same month of 1938. On March 31 the Illinois Bell had 971,989 telephones in service, as compared with 949,175 a year ago. For the first quarter of this year the company has experienced a net gain of 9,638 telephones, as compared with a gain of 3,577 in a like period for 1939.

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B. J. Carney & Co., 100 N. 7th St., Minneapolis, Minn.—Western red cedar poles. Pentrex Butt Treated or Plain.

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T. M. Partridge Lumber Co., Minneapolis, Minn.—Northern White—Western Red Cedar Poles. Plain or butt-treated.

Valentine Clark Corporation, 2516 Doswell Ave., St. Paul, Minn.—Finishd Cedar Poles. Plain or butt-treated.

Western Red Cedar Company, P. O. Box 663, Sandpoint, Idaho.—Plain or butt treated Western Red Cedar poles.

Construction Materials for Outside Plant

by **RAY BLAIN**

(Continued from page 18)

washer head lag screw is so designed that it must be screwed into a drilled hole rather than driven. The proper application of this hardware is extremely important. Locknuts must be used throughout to keep the parts firmly locked together.

Braces should be clamped between a threaded washer and the standard nut. Brace bolts at the arm should be placed with the washer head at the front of the crossarm, or at the back on the opposite side from the brace. Through bolts should be placed with the washer head at the back of the pole, except when the eye nuts or other fittings are to be used.

Insulators Used on Pole Lines

Glass insulators of various types have been improved considerably during the past few years. Occasionally old timers are heard lamenting the passing of the bottle green insulators. The only justification for this, however, must be on the sentimental side, for the clear glass type is in every way a superior insulator.

The bluish green color in the old glass insulators indicated the presence of impurities, such as iron and aluminum in varying quantities, which made a grade of glass less homogeneous than the present-day light-colored variety. Improvement in quality of the ingredients and methods of manufacture have made possible a gradual development of the clear, or flint, glass insulators at little, if any, increase in cost to the user.

The present-day glass insulators are far superior in every way to those in common use only a few short years ago. The improved types are tougher and more homogenous than at any time in the history of the industry. This superior quality is to a great extent due to the proper application of the thermal shock test. This test, in brief, consists of transferring the insulators from a hot water bath to a cold and then back to a hot bath.

The temperature differential is considerable, and the volume of water in each bath must be at least 50 times the volume of the glass immersed. This test is positive in its action in bringing out all hidden defects, indicates freedom from objectionable localized stresses in the glass, and insures a careful annealed and homogenous product.

Insulators tested in this manner insure years of good service out on the line in all kinds of weather. With present-day long-span construction and heavy line loads, good insulators are now more than ever a necessity for good service.

The threads of present-day glass insulators are accurately formed and gauged to insure an accurate fit to the threads of the wood pins. This is necessary to prevent floating insulators which have been a common source of line trouble in the past. The new insulator has also discarded the "drip points." These really served no useful purpose and were frequently the cause of injury to the hands of linemen. The bottoms of all modern glass insulators are now perfectly smooth.

The new clear glass insulators have been made better in every way than the old colored variety. First, they do not invite the nesting of insects, either under the insulator or between the petticoats. Many an otherwise good insulator has been ruined during rainy weather by spider webs under the petticoats and around the pins, causing a serious leakage and an associated loss in transmission. A telephone line is never any better than its wet weather insulation.

The clear glass, with the usual sky background, presents a far less desirable target for the small boy with a slingshot than did the old bottle-green variety which he enjoyed breaking so effectively, down through the years. Records of several large companies indicate that annual replacements of the new type insulators are far less than with the old blue or green glass of years gone by.

When a drop bracket is not used on transpositions, a special two-piece insulator is generally employed. These insulators are reported to cause some trouble in service due to the top part loosening on the pin and flopping over so as to cause a short-circuit of the two line wires. This difficulty has been overcome by the adoption of a special transposition insulator in one piece. It provides ample insulation and practically the same separation of the two wires as does the two-piece insulator and is

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Care and Handling of Screwdrivers and Pliers

Some experience is required to become skilled in the handling of pliers, screwdrivers, and other hand tools. Opinion differs as to the best methods and grips to use in handling pliers and screwdrivers. Those described herein are based on the most popular and generally used methods.

One of the first things to learn about tools is that there is *no substitute for good steel.* The cheap cast iron pliers and soft steel screwdrivers are more expensive in the long run than are high quality tools. Buy good tools and take care of them, and you will not be disappointed in the results.

Most Useful Tools for Telephone Repair Work

For general telephone repair work, the following screwdrivers and pliers are essential:

1 Pair 7-inch side-cutting pliers.
1 Pair 6-inch long-nose side-cutting pliers.
1 Pair 5-inch oblique-cutting pliers.
1 Pair 5½-inch spring adjusting pliers.
2 Pairs 8-inch splicing clamp pliers.
1 Standard electrician's knife.
1 6-inch cabinet screwdriver.
1 10-inch regular screwdriver.

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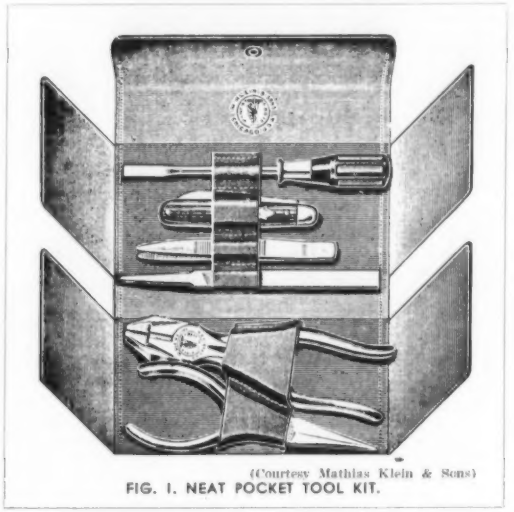


(Courtesy Mathias Klein & Sons)
FIG. 1. NEAT POCKET TOOL KIT.

1 3-inch small-blade screwdriver.
1 Contact burnisher.

For those who desire to carry a set of tools, neatly and compactly, tool kits such as are shown in Fig. 1 are available. For outside construction work additional hand tools are of course required.

Use of Screwdrivers

The correct use of a screwdriver will save a lot of hard work, as well as prevent the unsightly twisting of screw slots. The proper method of holding the screwdriver in the hand is shown in Fig. 2. The palm of the right hand should be firmly pressed against the butt of the screwdriver handle in order to apply sufficient pressure to keep the blade of the screwdriver in the slot of the screw head. The thumb and forefinger are placed along the handle to grip it near the base. By holding the screwdriver in the manner illustrated the tool forms an extension of the hand, and the turning of the screwdriver should be accomplished by turning the forearm rather than the wrist.

This method of handling a screwdriver has two distinct advantages: (1) The tool is turned around its own axis and hence has less tendency to slide out of the screw slot; and (2) considerably more power can be exerted by turning the forearm than can be obtained by twisting the wrist. The end of the blade is steadied and held in the screw slot with the left hand.

The method of maintaining the point or blade of the screwdriver is important. The screwdriver should not be given a "chisel-shaped edge," since this results in a tendency for the screwdriver to climb out of the screw slot when the driver is turned. Instead, the edges should be filed parallel, for with this shape of blade there is far less tendency for the screwdriver to leave the screw slot. The correct and the incorrect methods of filing a screwdriver bit are shown in Fig. 3.

The Use of Pliers

The proper method of holding pliers is shown in Fig. 4. In this grip, one handle of the pliers is placed against the palm of the hand with the thumb curling over this handle. The little finger is curled around the handle and presses it against the palm, thus holding the pliers securely in the palm of the hand. The third finger is placed on the inside of the second handle, while the first and second fingers are curled around the outside of the second handle.

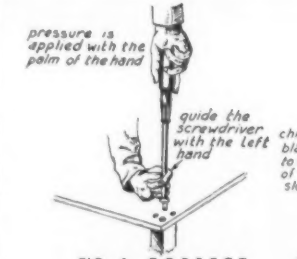


FIG. 2. CORRECT METHOD OF USING SCREWDRIVER.

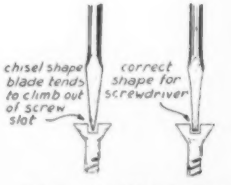


FIG. 3. INCORRECT AND CORRECT METHODS OF SHAPING SCREWDRIVER BLADE.

undoubtedly subject to far less trouble.

This type transposition insulator seems to be ideal for use on rural lines. While it does not provide the wide separation of the drop bracket, it is considerably less expensive. However, the line wires should be pulled to the proper tension and even, to avoid swinging together in the span on each side of the transposition insulator. The point type transposition places excessive strains on insulators although the new type has proved entirely suitable for this purpose.

Ordinary porcelain knobs are not used as extensively as formerly although they are still considered necessary on numerous telephone jobs. Drop-wire clamps are now ordinarily used in lieu of knobs for wire by the majority of telephone companies. Knobs, however, are still available in one, two and four grooves for those who prefer them and it must be admitted that they do continue to get the job done.

Special knobs are now frequently used to advantage in attaching drop-wire runs on buildings. These are the split knob, self-tying type, or nail knobs, and the insulated screw eye which may be obtained in either the closed or split type.

Another very convenient item of material is the angle screw knob. This knob is ordinarily used as the first drop attachment on a building. It may be conveniently mounted so that the drop may contact the building from any angle and still remain firmly in the groove of the knob.

(To be concluded)

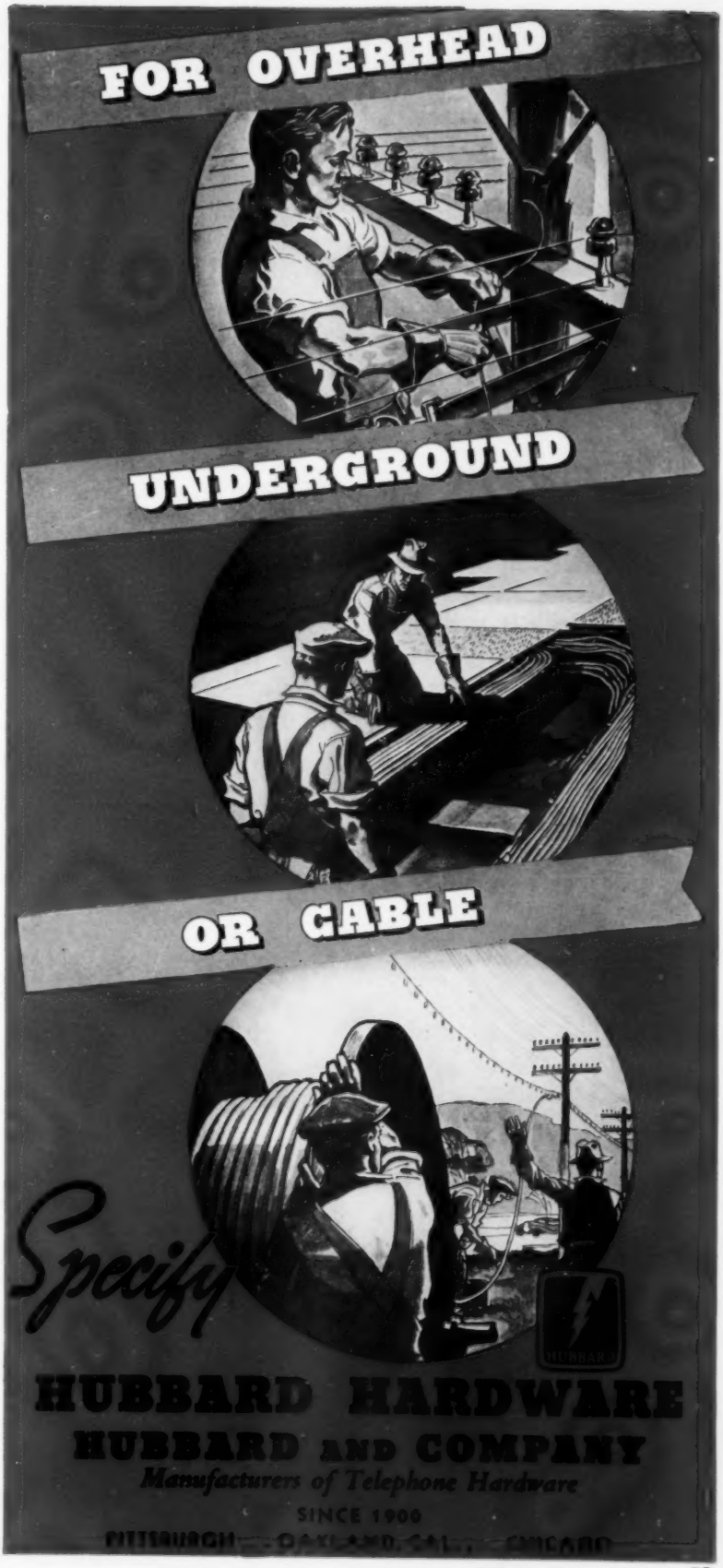
▼ ▼

User of Slugs in Pay Station Caught in St. Louis

After three months of watching, a pair of detectives recently succeeded in apprehending a user of telephone slugs in a public pay station in a drug store in St. Louis, Mo. The man was taken in custody by the detectives and turned over to the police after they had watched him deposit 14 steel washers about the size of quarters in payment for a long distance call.

The prisoner, who said he was John M. Sperry, a former race horse owner and a resident of St. Louis, had 40 washers in his pockets and 99 more in his automobile. Police said he admitted using slugs in making calls from coin telephone boxes, which would have cost him $325.

The detectives, Sergt. Anthony Kloeppel and Chauncey Sterling, said the prisoner made his calls in code.



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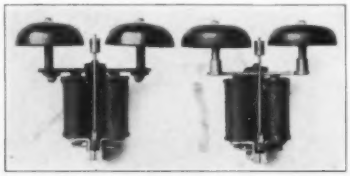

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